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Entry No. in PA ↓ **Title of paper** ↓

87093 PAC study of molecular rotational motions in dilute solutions.

Authors → A.Baudry, P.Boyer, J.D.Fabris, P.Vulliet (Lab. d'Interactions Hyperfines, CENG, Grenoble, France). ← **Author's affiliation**

Source of paper → *Hyperfine Interactions (Netherlands)*, vol.10, no.1-4, p.1057-62 (June 1981). (Proceedings of the Fifth International Conference on Hyperfine Interactions, Berlin, Germany, 21-25 July 1980).

The rotational tumbling of neutral chelates of hafnium dissolved in several organic solvents was studied via ^{181}Ta DPAC experiments. The results are compared with the predictions of a hydrodynamic model with partial slip boundary conditions. The influence of solute-solvent interactions and/or associations on the quadrupole relaxation is discussed. (16 refs.) } **Abstract**

Entries for other types of material differ mainly in the reference to the source, e.g., a report will refer to the report series and the number of the individual report. A conference paper on the other hand will normally refer to the title, place and date of the conference at which the paper was given.

SUBJECT ARRANGEMENT & SUBJECT GUIDE

The abstracts are arranged by subject in accordance with the scheme in the CLASSIFICATION and CONTENTS which appears opposite. The page number for the start of each subject section is given. An alphabetical index to the scheme—the SUBJECT GUIDE—follows the CLASSIFICATION and CONTENTS.

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SUBSIDIARY INDEXES

Where appropriate, the following subsidiary indexes are included for the convenience of users:

Bibliography index of articles where a significant list of references or bibliography is contained.

Book index of books received and abstracted.

Corporate Author index where a corporate organisation rather than an individual is responsible for publication. This index includes all reports.

Conference index with reference to individual papers.

Subscription prices and ordering procedure are shown on the inside back cover.

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CLASSIFICATION AND CONTENTS

The abstracts are arranged by subject in accordance with the following scheme. The page number for each section is given. The CLASSIFICATION AND CONTENTS is followed by an alphabetical guide to the scheme, the SUBJECT GUIDE.

The classification scheme is the result of cooperation between INSPEC, the American Institute of Physics, the European Physical Society and the Physics Working Group of the ICSU-AB.

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00.00 GENERAL

01.00 COMMUNICATION, EDUCATION, HISTORY, AND PHILOSOPHY

01.30 PHYSICS LITERATURE AND PUBLICATIONS

01.30C Conference proceedings

116910 Theoretical Symposium on Intense Medium Energy Sources of Strangeness.
AIP Conf. Proc. (USA), no.102 (1983).
Conference held at: Santa Cruz, CA, USA. Date 18-21 March 1983. Sponsors: Santa Cruz Inst. Particle Phys.; Nat. Sci. Found. et al. The following topics were dealt with: kaon factories; CP violation; weak interactions; rare kaon decays; strange particles; supersymmetric models; unified field theory; gauge field theory; left-right mixing; Higgs bosons. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116911 International Workshop on Strain Patterns in Rocks.
J. Struct. Geol. (GB), vol.5, no.3-4 (1983).
Conference held at: Rennes, France. Date 13-14 May 1982. The following topics were dealt with: strain analysis, gneiss, Fry's method, porphyroid, Massif Central, France, geology, orthographic analysis, deformation, Mohr circle construction, volume changes, chemical analysis, discontinuity, cleavage, ductile zones, shear zones, thrust zones, quartzite mylonite, Australia, Aar granite, plutons, Archaean greenstone, Ontario, Canada, Pardailhan Nappe, folding and ice caps.

116912 5th International Congress of Biorheology.
Biorheology (GB), vol.20, no.4 (1983).
Conference held at: Baden-Baden, Germany. Date 20-24 Aug. 1983. The following topics were dealt with: haemorheological disorders in cardiovascular diseases; permeability and the blood vessel wall; theoretical considerations in biorheology; normal and pathological mucus; role of haemorheology in blood transfusion; theoretical aspects of tissue deformability; RBC-mechanics and in vivo microcirculatory flow; some biorheological aspects of joint diseases; tumour microcirculation; red cells; microhaemodynamics; biological fluids. Abstracts of individual papers can be found under the relevant classification codes in future issues.

116913 SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369 (1983). [received: Sept. 1983]
Conference held at: Edinburgh, Scotland. Date 7-10 Sept. 1982. Sponsors: SPIE. The following topics were dealt with: vision; medical and biological applications; infrared; interferometry; measurement; remote measurement; nonlinear optics; astronomy; focus on industry; lasers and laser systems; spectroscopy; fibres and fibre sensors; image processing; holography and gratings; scattering and general theory. 114 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116914 Advanced Remote Sensing.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.363 (1983).
Conference held at: San Diego, CA, USA. Date 26-27 Aug. 1982. The following topics were dealt with: remote sensing, vegetation stress, satellite ocean colour measurement, fisheries, weather forcasting, USA, TV compatible thermal imager, signal processing, gyroscope, general theory of relativity, Spacelab 2 IR telescope, cooled grating IR spectrometer, Earth feature classification, CCD Digicon-detector system, mosaic focal plane, detection probability, Information Adaptive System, real time onboard image processing, bubble domain technology, spacecraft onboard memories and detector array signal acquisition.

116915 Optical Sensing Techniques, Benefits, Costs.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.376 (1983).
Conference held at: Teddington, Middx., England. Date 7-8 Dec. 1982. Sponsors: Inst. Measurement & Control; IEE. The following topics were dealt with: optical sensing and engineering metrology; surface form enhancement by heterodyne moire contouring; role for automatic fringe analysis in optical metrology; shutter modulator sensor with fibre optic links; optical fibre sensors for displacement measurement; automated visual control system for gob feeders; rapid video data capture and processing system for computer image measurement and analysis; optical sensing in product inspection; high speed photography and videography; advanced thermal imaging systems and their commercial applications; real time depth measurement in a stereoscopic television display; automatic inspection of fine lines and automatic visual inspection applied to silicon chip packaging. 17 papers were presented, of which 16 are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116916 First World Congress on Desalination and Water Re-Use.
Desalination (Netherlands), vol.44 (May 1983).
Conference held at: Florence, Italy. Date 23-27 May 1983. The following topics were dealt with: energetic and economics of desalination processes; materials and corrosion; solar and freezing processes; membrane processes; electrodialysis and water use and water recovery. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116917 Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3 (1983).
Conference held at: Dallas, TX, USA. Date 8-10 Feb. 1983. Sponsors: Army Res. Office; American Vacuum Soc. The following topics were dealt with: physics and chemistry of material growth; impurities and defect structures of $Hg_{1-x}Cd_xTe$ semiconductors; techniques for characterisation of $Hg_{1-x}Cd_xTe$ materials and electronic properties; physics of electronic and optical properties and semiconductor surfaces and interfaces. 38 papers were presented, of which 38 are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116918 Second Annual Conference of the American Association for Aerosol Research.
Aerosol Sci. & Technol. (USA), vol.2, no.2 (1983).
Conference held at: Washington, DC, USA. Date 18-21 April 1983. Sponsors: American Assoc. Aerosol Res. The following topics were dealt with: aerosol capture; aerosol growth; aerosol dynamics; particle transport; aerosol precursors; atmospheric sulphate aerosol formation and transport, and numerous other aspects of aerosol research. 158 papers were presented, of which 5 are published in full in the present proceedings, and 152 as abstracts only. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116919 Proceedings of the Meeting of the Astronomical Science Group of Ireland.
Irish Astron. J., vol.15, no.4 (Sept. 1982). [received: Sept. 1983]
Conference held at: Belfast, Northern Ireland. Date 15 Dec. 1981. The following topics were dealt with: galactic halo, peculiar early type stars, abundance analyses, spotted stars observations, black hole radiation and the night sky green light.

116920 10th Annual Conference of the Association for Aerosol Research (Gesellschaft fur Aerosolforschung).
J. Aerosol Sci. (GB), vol.14, no.3 (1983).
Conference held at: Bologna, Italy. Date 14-17 Sept. 1982. Sponsors: Univ. Bologna; Consiglio Nazionale delle Ricerche. The following topics were dealt with: airway deposition and clearance; diagnostic and therapeutic aerosols; aerosols in meteorology filtration of aerosols; generation of aerosols and air pollution; ultrafine aerosols and diffusion; chemistry of particulate air pollution; intercomparison of instrumentation; nonspherical particles; optics of aerosols and instrumentation; condensation and evaporation and nuclear and radioactive aerosols. 83 papers are published in the present proceedings.

116921 Meeting of the French and Belgian Societies for Electron Microscopy.
J. Microsc. & Spectrosc. Electron. (France), vol.8, no.3 (1983).
Conference held at: Liege, Belgium. Date 16-19 May 1983. The following topics were dealt with: grain boundary structure in hexagonal crystals; grain boundary structure observed by high resolution electron microscopy; electron diffraction of symmetrical tilt boundaries in germanium; characterisation of grain boundaries in silicon by TEM and EBIC; grain boundary structure and properties in engineering materials; intergranular segregation and precipitation; AES and STEM-EDS X-ray microanalysis studies of intergranular segregation and the identification of numerical simulation of contrasts visible in crystalline interfaces. 9 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116922 Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors).
J. Phys. Colloq. (France), vol.44, no.C-3 (June 1983).
Conference held at: Les Arcs, France. Date 11-15 Dec. 1982. The following topics were dealt with: the chemistry, characterization and transport properties of polyacetylene; the theory, magnetic and optical properties of polyacetylene; the electrochemistry, intercalation and applications of polyacetylene; and other polymers (polypyrrole, polyacrylonitrile, polydiacetylene, polyparaphenylene, etc.). 151 papers are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116923 Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals).
J. Phys. Colloq. (France), vol.44, no.C-3 (June 1983).
Conference held at: Les Arcs, France. Date 14-18 Dec. 1982. The following topics were dealt with: organic superconductors; physical, electronic and structural properties of $(TMTSF)_2$ and $(TMTTF)_2$ salts; electronic and structural properties of one-dimensional conductors; theory and applications of one-dimensional conductors; new materials; physical properties and theory of trichalcogenide compounds. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116924 European Geophysical Society Meeting on the Structure of the Upper and Middle Atmosphere.
Planet. & Space Sci. (GB), vol.31, no.9 (1983).
Conference held at: Leeds, England. Date 23-27 Aug. 1982. The following topics were dealt with: semi-empirical thermospheric models; determination of atmospheric composition and temperature from the UV airglow; solar indices and solar UV irradiances; photodissociation effects of solar UV radiations; 27-day variations in solar UV irradiance; chemical budgets of the stratosphere; the ozone budget in the stratosphere; ozone variability; the influence of biology on the composition of the atmosphere; and peroxyacetyl nitrate in the troposphere and lower stratosphere. 15 papers were presented, of which 10 are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116925 Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares.
Sol. Phys. (Netherlands), vol.86, no.1-2 (1983).
Conference held at: Tokyo, Japan. Date 5-8 Oct. 1982. Sponsors: Japan Soc. Promotion of Sci.; U.S. Nat. Sci. Found. Artificial satellites, instruments, flares, energy transport, chromosphere heating and evaporating, emission processes and source structures, high energy photons, nuclear processes and particle acceleration.

116926 Scanning Electron Microscopy 1983 Conference.
Scanning Electron Microsc. (USA), pt.1 (1983).
Conference held at: Dearborn, MI, USA. Date 17-22 April 1983. Sponsors: Scanning Electron Microscopy Inc. The following topics were dealt with: surface analysis; analytical electron microscopy; other analytical techniques; material characterization; electron beam testing in semiconductors; electronics of semiconductors; particle characterization; geological applications; forensic sciences; backscattered electron imaging in biology; biological specimen preparation; neurobiology; clinical applications; biological microanalysis; sensory organs; blood and blood-vascular systems; microbiology; parasitology; cell culture; cancer; stones and crystals; bone and biomineralization; muscle; kidney; skin biology; respiratory system; cell surface labelling; developmental biology and plant biology. 96 papers were presented. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116927 First International Conference on Advances in Ferrography.
Wear (Switzerland), vol.90, no.1 (15 Sept. 1983).
Conference held at: Swansea, Wales. Date 22-24 Sept. 1982. The following topics were dealt with: continuous wear measurement; online ferrography; wear particles; arthritic disease application; particle size distribution. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116928 Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium.
Vienna, Austria: IAEA (1983), 729 pp.
Conference held at: Munich, Germany. Date 11-15 Oct. 1982. The following topics were dealt with: experience with control and instrumentation of nuclear power plants; advanced systems for operator support; protection systems; control systems; measurement techniques; reliability, qualification and maintainability. 49 papers were presented, of which all are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116929 Laser 83 Opto-Elektronik. 6th International Congress and International Trade Fair (papers in summary form only received).
Munich, Germany: Munchener Messe-und Ausstellungsgesellschaft (1983), 260 pp.
Conference held at: Munchen, Germany. Date 27 June-1 July 1983. The following topics were dealt with: optoelectronic components and sensors; optoelectronic signal transmission; lasers in material processing; CO_2 laser systems and diagnostics; lasers and optoelectronics in medicine.

116930 AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel.
Neuilly-sur-Seine, France: AGARD (1983), ix+428 pp.
Conference held at: Issy-les-Moulineaux, France. Date 18-22 Oct. 1982. Discusses frequency spectrum allocation and interference problems for both terrestrial and satellite radio links. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116931 Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers.
London, England: Plastics & Rubber Inst. (1982), xv+306 pp.
Conference held at: Cambridge, England. Date 29 March-1 April 1982. The following topics were dealt with: deformation and yield; fracture; crazing; fatigue; fibre composite materials; time dependent phenomena; effects of processing. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

116932 Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute.
Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff (1981), xiv+913 pp. [90 286 2161 X]
Conference held at: Norwich, England. Date 23 July-4 Aug. 1979. Sponsors: NATO. Three interrelated subjects are discussed: scattering methods for low and intermediate frequencies; high frequency scattering methods and related application areas; and mechanisms of biological interaction and microwave bioeffects. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

Proceedings of the 26th Conference on Great Lakes Research (papers in summary form only received) .... See Entry 121378

01.30K Handbooks, dictionaries, tables and data compilation

116933 Revision of the evaluated UKCNDC Activation-Product Decay-Data Library. A.L.Nichols (Technol. Div., AEE Winfrith, Dorchester, England).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1249-58 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
The Data Library Sub-committee of the UK Chemical Nuclear Data Committee (UKCNDC) is responsible for the construction and maintenance of the following radioactive-decay-data libraries: (1) Fission-Product Decay Data (UKFPDD-2), (2) Activation-Product Decay Data (UKPADD-1), (3) Heavy-Element Decay Data (UKHEDD-1). Efforts have begun to expand the Activation-Product Decay-Data Library considerably in order to satisfy decay-data requirements for possible fusion-as well as fission-reactor systems. This new library (UKPADD-2) will contain decay data for 410 nuclides. (17 refs.)

116934 Sensitivity factors for XPS analysis of surface atoms. C.D.Wagner (Surfex Co., Oakland, CA, USA).
J. Electron Spectrosc. & Relat. Phenom. (Netherlands), vol.32, no.2, p.99-102 (Sept. 1983). (11 refs.)

116935 Computer-calculated potential pH diagrams to 300°C. Vol.II: Handbook of diagrams. C.M.Chen, K.Aral, G.J.Theus.
Report EPRI-NP-3137, Electr. Power Res. Inst., Palo Alto, CA, USA (June 1983), 122 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The authors present a diagram handbook showing the many potential pH diagrams for specific elements in water at temperatures ranging from 25 to 300°C. These diagrams can serve as guides to help devise mechanisms that describe the corrosion processes.

116936 24th 1982 meteorological yearbook of Ispra. G.Bollini, A.Galva, C.Gandino, E.Porrati.
Report EUR 8538 IT, Comm. European Communities, Luxembourg (1983), v+88 pp. In Italian.
After a short description of the methods of measuring and analysing atmospheric phenomena, many tables and graphics for the meteorological year 1982 are reported with English titles.

01.30R Surveys and tutorial papers; resource letters

Educational image processing: an overview .... See Entry 116939

GEC research—sensors .... See Entry 117160

Sensors and their applications .... See Entry 117161

Sensors for mechanical properties .... See Entry 117162

A review of mathematical modelling of instrument transducers .... See Entry 117166

World-wide directory of manufacturers of vacuum plant, components and associated equipment—1983 .... See Entry 117193

Critical review of definitions of metamerism .... See Entry 117214

Distribution-free estimation of sphere size distributions from slabs showing overprotection and truncation, with a review of previous methods .... See Entry 117229

Applications of Auger spectroscopy .... See Entry 117280

FASTBUS—a standard for the design of high-speed, fourth-generation electronic apparatus (review) .... See Entry 117740

Introduction to moment methods with simple applications .... See Entry 118032

Introduction to geometrical optics .... See Entry 118075

Chemical lasers: new results and ideas .... See Entry 118134

Pulsed-pump tunable lasers .... See Entry 118158

Fiberoptic communications. Status and prospects for development .... See Entry 118275

Radiation-optical properties of quartz glass fiber-optic waveguides (review) .... See Entry 118293

Integrated-optics elements and systems .... See Entry 118303

Ultrasound imaging .... See Entry 118339

Holographic interferometry in vibration measurements .... See Entry 118541

Electron cyclotron emission and absorption in fusion plasmas .... See Entry 118712

High temperature plasma diagnostics by beam probe spectroscopy .... See Entry 118760

Quantum theory of ordered alloys of transition and noble metals .... See Entry 118962

Atom-vacancy states in crystals .... See Entry 119014

The study of grain boundary structure and properties in engineering materials .... See Entry 119029

Photostimulated diffusion in semiconductors .... See Entry 119063

Recent developments in the experimental determination of thermodynamic quantities of metals and alloys .... See Entry 119218

Survey of extant data for the surface tension of iron and its binary alloys .... See Entry 119314

Phase transitions in adsorbed films .... See Entry 119350

Electronic structure of transition metals under pressure .... See Entry 119424

Electron configuration and X-ray emission spectra of intermetallic compounds with CsCl structure .... See Entry 119425

Electrical, optical and glass transformation properties of amorphous solids—a review .... See Entry 119543

The Bechgaard salts: magnetotransport, dimensionality, spin density waves and the threshold field .... See Entry 119563

Laser Raman scattering spectroscopy of crystals .... See Entry 120051

Intergranular segregation phenomena studied by AES .... See Entry 120194

Thermodynamic calculations for the chemical vapor deposition of silicon nitride .... See Entry 120256

Magnetic structure analysis .... See Entry 120545

Trace element determination by atomic spectroscopic methods—state of the art .... See Entry 120687

Materials for photothermal solar energy conversion corrosion processes .... See Entry 120756

Nonvisual color perception: a critical review .... See Entry 120812

Colour vision in animals .... See Entry 120851

Expiratory flow limitation .... See Entry 120879

Joint models, degrees of freedom, and anatomical motion measurement .... See Entry 120932

Recent trends of medical image processing .... See Entry 120966

Present status of medical imaging apparatus .... See Entry 120967

Nuclear magnetic resonance imaging: an overview .... See Entry 120982

Occupational exposure in medicine—a review of radiation doses to hospital staff in north-west England .... See Entry 121010

Recent topics in medical measurements .... See Entry 121043

Seismic oscillations of the Earth's surface as a function of local conditions .... See Entry 121136

Vertical movements along the margins of the Atlantic Ocean .... See Entry 121202

The α-β transition of quartz; a view of some current problems: order-disorder or displacive transition, thermodynamic behaviour .... See Entry 121212

Progress of thermoluminescence research on geological materials .... See Entry 121228

Rates of surface processes on slopes, slope retreat and denudation .... See Entry 121245

Chemical budgets of the stratosphere .... See Entry 121340

Atmospheric composition: influence of biology .... See Entry 121343

Use of lasers in hydrometeorological research and for environmental monitoring .... See Entry 121382

A point of view on semi-empirical thermospheric models .... See Entry 121418

Photodissociation effects of solar UV radiation .... See Entry 121421

Energetic electrons as an energy transport mechanism in solar flares .... See Entry 121663

Genesis stories for the millisecond pulsar .... See Entry 121716

The origin of the Gum Nebula .... See Entry 121755

01.30T Bibliographies

116937 Reports, standards, and safety guides. E.G.Silver, D.S.Queener. *Nucl. Saf. (USA)*, vol.24, no.4, p.568-74 (July-Aug. 1983).
The authors present five lists of various documents relevant to nuclear safety. These lists are foreign reports (received under exchange agreements), reactor operations-related reports of US origin, other books and reports, regulatory guides, and nuclear standards. Each list contains the documents in its category which were published (or became available) during March-April 1983. The availability and cost of the documents are given in most instances. (no refs.)

116938 An electron energy-loss bibliography. R.F.Egerton, M.Egerton (Phys. Dept., Univ. of Alberta, Edmonton, Canada).
Scanning Electron Microsc. (USA), pt.1, p.119-42 (1983). (Scanning Electron Microscopy 1983 Conference, Dearborn, MI, USA, 17-22 April 1983).
This bibliography lists recent publications related to electron energy-loss spectroscopy carried out in an electron microscope, particularly those relevant to inner-shell spectroscopy and elemental analysis. It contains approximately 700 entries, listed alphabetically within 24 sections, each section dealing with a different aspect of experimental technique, practical application or theory. The emphasis is on measurements carried out using a transmission electron microscope, and especially on the use of inner-shell spectroscopy for elemental analysis, but references are also given to valence-loss studies and to measurements and calculations of inelastic scattering cross sections. (708 refs.)

Seismic oscillations of the Earth's surface as a function of local conditions ...... See Entry 121136

Progress of thermoluminescence research on geological materials ...... See Entry 121228

01.40 EDUCATION

116939 Educational image processing: an overview. J.R.Jensen (Dept. of Geography, Univ. of South Carolina, Columbia, SC, USA).
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.8, p.1151-7 (Aug. 1983).
Digital image processing is often an integral part of a student's education in remote sensing. Such instruction is normally accomplished by (1) providing digital image processing laboratory assignments within the context of introductory remote sensing courses and/or (2) teaching separate classes or seminars specifically oriented toward digital image processing of remotely sensed data. The general course content of such approaches is briefly reviewed. In addition, image processing system configurations to support these scenarios are identified and discussed. (56 refs.)

01.50 EDUCATIONAL AIDS

116940 Demonstration of holograms. I.Leifer (Dept. of Phys., Napier Coll., Edinburgh, Scotland).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.474-7 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Demonstration of holograms made by students from the Physics Department of Napier College, Edinburgh. One of the holograms shown illustrates the relationship between the orthoscopic and pseudoscopic images when both images are virtual. (5 refs.)

116941 Instructional use of a mainframe interactive image analysis system. T.H.L.Williams, C.Gunn, J.Siebert (Dept. of Geography-Meteorology, Univ. of Kansas, Lawrence, KS, USA).
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.8, p.1159-65 (Aug. 1983).
The increasing demand for training in digital image analysis techniques calls for the widespread development of suitable training courses in academic institutions. Implementation of image analysis program packages on college and university mainframe computers can aid this development in a cost-effective manner. The Department of Geography-Meteorology and the Kansas Applied Remote Sensing (KARS) Program have developed an instructional interactive image analysis program package that runs on the University of Kansas central computer. A brief description of the program package is given, followed by a discussion of the advantages and limitations of image analysis instruction in a time-sharing mainframe environment. (3 refs.)

116942 Digital image processing using the Apple II microcomputer. R.W.Kiefer (Dept. of Civil & Environmental Engng., Univ. of Wisconsin, Madison, WI, USA), F.J.Gunther.
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.8, p.1167-74 (Aug. 1983).
The inexpensive Apple II microcomputer can be used for digital image processing in operational and educational environments. The Apple II is portable enough to be taken directly into the classroom for lecture demonstrations and laboratory exercises. It is easily taken into the field for on-site data analysis or local presentations. Processing results can be displayed on a color monitor/TV screen in either low-resolution or high-resolution graphics, or can be printed on a line printer. At least five digital image processing systems (software packages) are in use in the United States: Apple II Digital Image Processing System (A/DIPS), Apple Image Processing Educator (AIPE), Oklahoma Landsat Training Program System, Apple Personal Image Processing System (APPLEPIPS), and Mini-LARSYS. (10 refs.)

116943 A hybrid image classification instructional package. J.R.Eyton (Dept. of Geography, Pennsylvania State Univ., University Park, PA, USA).
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.8, p.1175-81 (Aug. 1983).
An introductory undergraduate course in digital remote sensing has been successfully conducted using a combination of Landsat image processing programs and mainframe statistical and mapping library routines. This hybrid approach allows for considerable flexibility and makes maximum use of the software and hardware commonly supported by an academic computer center. Students work through the entire classification process starting with Landsat image subsets extracted from a Computer Compatible Tape and finishing with a colored hard copy map of the final classification. Emphasis is placed on students understanding the various classification procedures at the expense of image processing efficiency. A number of different computer graphic algorithms are used to facilitate the students' comprehension of both the spatial and statistical content of the image data. (6 refs.)

01.65 HISTORY OF SCIENCE

116944 The constancy of the laws of physics in the light of prehistoric nuclear reactors. J.M.Irvine (Dept. of Theoretical Phys., Manchester Univ., Manchester, England).
Contemp. Phys. (GB), vol.24, no.5, p.427-37 (Sept.-Oct. 1983).
The constancy of the laws of physics is an essential ingredient in the development of science and is implicitly assumed in the application of physics to the interpretation of astronomy and geology. The author reviews the present status of the tests of the temporal invariance of the basic interactions of physics. It reaches the conclusion that experimental tests are consistent with no time variation of the gravitational constant, but points to a fundamental difficulty in interpreting such results. The most precise tests of the temporal variation of the electromagnetic interaction together with the strong and weak nuclear forces are supplied by an analysis of neutron capture cross-sections in the spontaneous fossil nuclear reactor established in Gabon two thousand million years ago. (6 refs.)

116945 Born, the innovator. L.R.Baker (Sira Ltd., South Hill, Chislehurst, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.2-7 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The essence of innovation, which is the successful combination of need and technical feasibility, was well illustrated by Born in his analogue computer for determining Fourier transforms of a number of different functions which occur in acoustics, optics and X-ray crystal analysis. After a brief description of the first photo-electric Fourier transformer, which involved rotating a sine grating behind a slit to select a range of spatial frequencies, subsequent developments of Born's basic idea are discussed and, in particular, its use in equipment for measurement of the optical transfer function (OTF). The widespread use of this equipment has led to several international exchanges of information on standards relating to image quality and, even after 20 years of intense technical development throughout the world, the performance of OTF systems based on Born's idea has not so far been surpassed. (8 refs.)

116946 Hydrophobic interactions—a historical perspective. F.Franks (Dept. of Botany, Univ. of Cambridge, Cambridge, England).
Faraday Symp. Chem. Soc. (GB), no.17, p.7-10 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
Hydrophobic effects play a dominant role in a variety of technological processes, in the stabilization of supermolecular biological structures and in the mechanisms associated with biosynthesis, metabolism and physiological function. The author attempts to trace the development of the understanding of hydrophobic effects from the thirties onwards. (29 refs.)

116947 Rutherford and beta decay. W.E.Burcham (Dept. of Phys., Univ. of Birmingham, Birmingham, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1797, p.215-39 (8 Oct. 1983).
Rutherford's concern for the properties of the α-particle did not divert him from the more difficult task of characterizing beta decay. The lecture traces the experimental steps by which some of the main features of this process were established in his laboratories at Montreal, Manchester and Cambridge. It concludes with a brief account of some beta-decay experiments that throw light on the mass of the Z^0 boson of the weak interaction. (64 refs.)

01.90 OTHER TOPICS OF GENERAL INTEREST

Status report on ASTM E-42 Committee on surface analysis .... See Entry 120697

02.00 MATHEMATICAL METHODS IN PHYSICS

02.10 ALGEBRA, SET THEORY, AND GRAPH THEORY

116948 Branching rules for irreducible representations of E_8 into D_8. G.Belanger (Dept. of Phys., Johns Hopkins Univ., Baltimore, MD, USA).
J. Phys. A (GB), vol.16, no.15, p.3421-33 (21 Oct. 1983).
The branching rules for irreducible representations of E_8 into D_8 are calculated using the knowledge of the Kronecker products for those two algebras. Tables of Kronecker products for both E_8 and D_8 algebras are also included. (11 refs.)

116949 Geometric convergence of some two-point Pade approximations. G.Nemeth (Central Res. Inst. for Phys., Budapest, Hungary).
In *Collection of scientific papers in collaboration with joint Institute for Nuclear Research, Dubna, USSR and Central Research Institute for Physics, Budapest, Hungary. Algorithms and programs for solution of some problems in physics. Vol.IV*, p.85-96. Report KFKI-1983-21, Hungarian Acad. Sci., Budapest (1983), 191 pp.
The authors present the geometric convergence of some two-point Pade approximations on certain infinite sets of the complex plane is considered. (no refs.)

A new approach to permutation group representations. II ...... See Entry 116957

Associated Legendre functions on the cut .... See Entry 116962

Logicoalgebraic approach to Lagrangian systems .... See Entry 116974

Monotonicity of energy eigenvalues for Coulomb systems ...... See Entry 116975

Coupling of quantum logics .... See Entry 117012

Accurate calculation of the eigenvalues of the $x^2+\lambda x^2/(1+gx^2)$ potential .... See Entry 117014

The eigenvalues of the bounded λx^{2m} oscillators .... See Entry 117015

Non-associative properties of a deformed Poisson product and the quantisation problem .... See Entry 117025

Yes-no experiments and ordered structures in quantum physics .... See Entry 117037

On the spherical harmonics and discrete ordinates methods for azimuth-dependent intensity calculations .... See Entry 117125

Irreducible representations of superalgebras B(1,1) and B(0,2) .... See Entry 117374

02.20 GROUP THEORY

(for algebraic methods in quantum mechanics, see 03.65; for symmetries in elementary particle physics, see 11.30)

116950 A note on the $K(\pi,1)$ property of the orbit space of the unitary reflection group G (m,l,n). T.Nakamura (Dept. of Math., Univ. of Tokyo, Tokyo, Japan).
Sci. Pap. Coll. Arts & Sci. Univ. Tokyo (Japan), vol.33, no.1, p.1-6 (June 1983). (5 refs.)

116951 Cohomology groups in the Cartesian product of countably infinite number of complex planes. Y.Fujimoto (Dept. of Pure & Appl. Sci., Univ. of Tokyo, Tokyo, Japan).
Sci. Pap. Coll. Arts & Sci. Univ. Tokyo (Japan), vol.33, no.1, p.41-53 (June 1983).
The properties of holomorphic functions on the Cartesian product of countably infinite number of complex planes, which will be denoted by ΠC, have been discussed by many authors. Among others, Rickart (1969) proved that for any polynomially convex compact subset Ω of ΠC $H^k(\Omega,O)=0$ for $k\geq 1$ by using a theorem on sheaves represented as the inductive limit of some sheaves. On the other hand, Dineen (1976) proved that for any open set U in ΠC, $H^1(U,O)\neq 0$ by showing that the first Cousin problem is not solvable on U. The author introduces a fine subsheaf $\mathcal{E}_b$ of the sheaf of infinitely differentiable functions on ΠC. Then, it is shown that there is a fine resolution of the sheaf O on ΠC. (9 refs.)

116952 Standard Young tableaux and weight multiplicities of the classical Lie groups. R.C.King, N.G.I.El-Sharkaway (Faculty of Math. Studies, Univ. of Southampton, Southampton, England).
J. Phys. A (GB), vol.16, no.14, p.3153-77 (1 Oct. 1983).
By examining the branching rules for all irreducible representations of the classical groups U(k), SU(k), SO($2k+1$), Sp($2k$) and SO($2k$) on restriction to U(1)×U(1)×U(1), standard Young tableaux are specified for each of these groups. It is shown that these tableaux determine the corresponding characters of the irreducible representations. The rules for constructing these tableaux are derived and in this way the determination of weight multiplicities is reduced to a simple combinatorial exercise. General formula for such weight multiplicities are given encompassing the most difficult case: namely that of SO($2k$). Illustrative examples are provided, including some yielding the explicit k-dependence of weight multiplicities. (29 refs.)

116953 The Gel'fand basis and matrix elements of the graded unitary group U(m/n). J.-Q.Chen, X.-G.Chen (Dept. of Phys., Nanjing Univ., Nanjing, China).
J. Phys. A (GB), vol.16, no.15, p.3435-56 (21 Oct. 1983).
Projection operators with correct normalisation are constructed for obtaining the Gel'fand basis $|(^{[\nu]}{}_{(m)})\rangle$ of the graded unitary group U(m/n). Each U(m/n) Gel'fand basis vector $|(^{[\nu]}{}_{(m)})\rangle$ for an f-particle system uniquely corresponds to a non-standard basis vector $|[\nu](m)\rangle$ of the permutation group S(f). The matrix element of the generator $E^{i-1}{}_{i}$ of U(m/n) between the two Gel'fand basis vectors $|(^{[\nu]}{}_{(m)})\rangle$ and $|(^{[\nu]}{}_{(m)})\rangle$ is proportional to the overlap between the two non-standard basis vectors $|[\nu](m')\rangle$ and $|[\nu](m)\rangle$ of S(f). Explicit formulae are given for the normalisation constant in the projection operator as well as for the matrix elements of the generator $E^{i-1}{}_{i}$ of the graded unitary group U(m/n), which is the extension of the Gel'fand-Tsetlin formula for the ordinary unitary group U(m). (22 refs.)

116954 Supergroups have no extra topology. R.F.Picken (Inst. fur Theorie der Elementarteilchen, Freie Univ. Berlin, Berlin, Germany).
J. Phys. A (GB), vol.16, no.15, p.3457-62 (21 Oct. 1983).
The global topology of supergroups is studied and it is found that they are equivalent as far as homotopy is concerned to the product of the underlying ordinary Lie groups. (4 refs.)

116955 Kac-Dynkin diagrams and supertableaux. J.Bars (CERN, Geneva, Switzerland), B.More, H.Ruegg.
J. Math. Phys. (USA), vol.24, no.9, p.2253-62 (Sept. 1983).
Shows the relation between Kac-Dynkin diagrams and supertableaux. (14 refs.)

116956 The SO(7) polynomial basis for symmetric representations. P.De Wilde, H.De Meyer, G.Vanden Berghe (Seminarie voor Wiskundige Natuurkunde, Rijksuniv. Gent, Gent, Belgium).
J. Math. Phys. (USA), vol.24, no.9, p.2263-5 (Sept. 1983).
A polynomial basis is derived for the symmetric irreducible representations of the group SO(7). The reduction of SO(7) into $[SU(2)]^3$ is considered. The SO(7) generators not belonging to $[SU(2)]^3$ are grouped into a bispinor vector, of which matrix elements are calculated. An explicit expression for the state vector is given. (5 refs.)

116957 A new approach to permutation group representations. II. Cheng-Jiu Zhu (Phys. Dept., Jilin Univ., Changchun, China), Jin-Quan Chen.
J. Math. Phys. (USA), vol.24, no.9, p.2266-7 (Sept. 1983).
For pt.I see ibid., vol.23, p.928 (1982). The formula for the Yamanouchi matrix elements is rederived by the eigenfunction method in a simple fashion. (8 refs.)

116958 A deformation of the general zero-curvature equations associated to simple Lie algebras. B.Kupershmidt (Los Alamos Nat. Lab., Los Alamos, NM, USA), D.Peterson.
J. Math. Phys. (USA), vol.24, no.9, p.2296-300 (Sept. 1983).
Constructs deformations and rational reductions for all the general zero-curvature equations associated to simple complex Lie algebras [known as AKNS equations for sl(2,C)]. (7 refs.)

Branching rules for irreducible representations of E_8 into D_8 .... See Entry 116948

The geometric theory of deformation and linearization of Pfaffian systems and its applications to system theory and mathematical physics. I .... See Entry 116965

Extension of relativistic kinematics .... See Entry 116988

Nonlinear quantum dynamical semigroups for many-body open systems .... See Entry 117076

Analytic approximations to Hamiltonian lattice field theories. I. Periodic gaussian model for U(1) theories .... See Entry 117314

Irreducible representations of superalgebras B(1,1) and B(0,2) .... See Entry 117374

02.30 FUNCTION THEORY, ANALYSIS

116959 Justification of the averaging method for functional-differential equations with maximums. D.D.Bainov, S.D.Milusheva.
Hadronic J. (USA), vol.6, no.4, p.1034-9 (July 1983).
The averaging method is justified for a class of functional-differential equations with maximums. (3 refs.)

116960 Recurrence formula and conserved quantity of the Benjamin-Ono equation. Y.Matsuno (Mitsubishi Heavy Industries Ltd., Nagoya Aircraft Works, Nagoya, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.2955-8 (Sept. 1983).
It is shown, by using a recurrence formula derived from the Backlund transformation of the Benjamin-Ono (BO) equation, that the functional derivative of a conserved quantity of the BO equation is a conserved density.

116961 Single cell high order difference methods for the Helmholtz equation. R.P.Manohar, J.W.Stephenson (Dept. of Maths., Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada).
J. Comput. Phys. (USA), vol.51, no.3, p.444-53 (Sept. 1983).
A procedure for deriving certain high order difference formulas for the Helmholtz equation is given. Families of formulas of order 2, 4, and 6 are derived. The distinction between 'atomic' and 'nonatomic' formulas is made, and a nonatomic formula of order 4 is given for a similar equation with variable coefficients. Numerical results using these formulas are given. (8 refs.)

116962 Associated Legendre functions on the cut. F.W.Olver (Inst. for Phys. Sci. & Technol., Univ. of Maryland, College Park, MD, USA), J.M.Smith.
J. Comput. Phys. (USA), vol.51, no.3, p.502-18 (Sept. 1983).
Algorithms and a code are described for the computation of the associated Legendre functions, $P_\nu^\mu(\cos\theta)$, $P_\nu^{-\mu}(\cos\theta)$, $Q_\nu^\mu(\cos\theta)$ and the normalized Legendre polynomial $\bar{P}_\nu^\mu(\cos\theta)$ in the ranges $0<\theta\leq{}^1/_2\pi$, $\mu=0,1,2,\ldots$, $-{}^1/_2\leq\nu<\infty$. The algorithms are based on power-series expansions and recurrence relations. They are executed in extended-range arithmetic, thereby admitting very extensive ranges of μ and ν without causing overflow or underflow. (23 refs.)

116963 Periodic solutions of differential equations and one-parameter family of operators. T.Pomentale (European Organization for Nuclear Res., Geneva, Switzerland).
J. Comput. Phys. (USA), vol.51, no.3, p.527-35 (Sept. 1983).
A method for computing bounds to periodic solutions of the system $y'=f(t,y)$, $y,f\in R^n$, f periodic in t with period T, (1) is studied using an integral equation $y=G_\lambda y$ (2), depending on a parameter λ, and whose solutions for each λ are the periodic solutions of (1). λ is then given a value λ_0 so as to determine a set S for which $G_{\lambda 0}S\subset S$. Since $G_{\lambda 0}$ is proved to satisfy Schauder's conditions, then in S there is a solution of (2), i.e. a periodic solution of (1). The method, which evidently also constitutes an existence proof in S, has the peculiarity of being quite general since it can be used to bound other kinds of solutions of the system $y'=f(t,y)$, by simply setting up a different integral equation $y=G_\lambda y$ which possesses the solutions to be bounded. This method has then been used to bound periodic solutions of a system arising from the dynamics of two floating bodies, for which $G_\lambda S\subset S$ has the form of a system of inequalities. (3 refs.)

116964 Application of reciprocal Backlund transformations to a class of nonlinear boundary value problems. C.Rogers (Dept. of Appl. Math., Univ. of Waterloo, Waterloo, Ontario, Canada).
J. Phys. A (GB), vol.16, no.14, p.L493-5 (1 Oct. 1983).
It is shown that reciprocal Backlund transformations may be used to reduce an important class of nonlinear boundary value problems for higher-order nonlinear diffusion equations to linear canonical boundary value problems. (6 refs.)

116965 The geometric theory of deformation and linearization of Pfaffian systems and its applications to system theory and mathematical physics. I. R.Hermann (Assoc. for Phys. & Systems Math. Inc., Brookline, MA, USA).
J. Math. Phys. (USA), vol.24, no.9, p.2268-76 (Sept. 1983).
Many physical and engineering problems lead to the study of the qualitative and geometric properties of differential equations and their solutions as a function of exogeneous parameters. The theory of deformation of geometric structures and pseudogroups initiated by K. Kodaira and D.C. Spencer (1960, 1962) deals with the common mathematical structure underlying these problems. This series of papers will adapt the work in the pure mathematics literature to the needs of the applications, with the emphasis on the theory of deformations of Pfaffian systems. The applied area to be emphasized in this first part is the theory of nonlinear input-output systems. The author will also present the abstract algebraic structure which seems to underlie the theory of Pfaffian systems, which he calls Cartan-Vessiot filtrations of Lie algebras. (47 refs.)

116966 Painleve property and multicomponent isospectral deformation equations. D.V.Chudnovsky, G.V.Chudnovsky (Dept. of Maths., Columbia Univ., New York, NY, USA), M.Tabor.
Phys. Lett. A (Netherlands), vol.97A, no.7, p.268-74 (12 Sept. 1983).
The Painleve property for partial differential equations proposed by Weiss, Tabor and Carnevale (see J. Math. Phys., vol.24, p.522, 1982) is studied for two and three-dimensional multicomponent and matrix isospectral deformation systems. Applications to pole dynamics are presented. (23 refs.)

116967 A comment on Backlund transformations connected with the Sturm-Liouville operator. W.Strampp, K.-H.Briz (Fachbereich Math., Gesamthochschule Kassel, Kassel, Germany).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.85-92 (July 1983).
There exists a well-known transformation associating different Sturm-Liouville equations. It is shown that this transformation as well applies to equations occuring in the Lax formulation of various nonlinear equations. This leads immediately to bilinear Backlund transformations. (18 refs.)

A deformation of the general zero-curvature equations associated to simple Lie algebras .... See Entry 116958

An analysis of two-step time discretizations in the solution of the linearized shallow water equations .... See Entry 116971

A new class of integrable systems .... See Entry 116976

Integrability of Hamiltonians with third- and fourth-degree polynomial potentials .... See Entry 116977

Opitmal control of periodic vibrations of a vibration-impact system .... See Entry 116980

Simple waves in quasilinear hyperbolic systems. I. Theory of simple waves and simple states. Examples of applications .... See Entry 117000

Simple waves in quasilinear hyperbolic systems. II. Riemann invariants for the problem of simple wave interactions .... See Entry 117001

Regular solutions of wave equations containing nonlinearities of the type $L\Phi L$ .... See Entry 117003

The isospectral property for a family of non-self-adjoint operators .... See Entry 117026

Analytical expression for the double-frequency Coulomb Green's function with explicitly separated singularities .... See Entry 117051

Application of the theory of generalized rays to diffractions of transient waves by a cylinder .... See Entry 117053

Space-time integral equation solution for hard or soft targets in the presence of a hard or soft half space .... See Entry 117054

Relation between the kinetic method and the correlation-function method for the self-diffusion coefficient .... See Entry 117070

Relaxation of systems under the effect of a Gaussian white noise. Kolmogorov backward equation method .... See Entry 117085

The application of Green's function to the investigation of the response of vehicle accelerating over random profile .... See Entry 117091

Numerical-analytical algorithm for solving transfer equations for a plane layer .... See Entry 117122

On the spherical harmonics and discrete ordinates methods for azimuth-dependent intensity calculations .... See Entry 117125

An SL(2,*C*)-invariant representation of the Dirac equation. II. Coulomb Green's function .... See Entry 117326

Mathematical modelling for experimental physics data processing .... See Entry 117741

Introduction to moment methods with simple applications .... See Entry 118032

On the propagation of electromagnetic waves in scattering stratified media treated by the Green's method .... See Entry 118039

Present thinking on the use of the singularity expansion in electromagnetic scattering computation .... See Entry 118048

Parametric identification of transient electromagnetic systems .... See Entry 118049

Surface integral equations for conducting and dielectric bodies .... See Entry 118051

Aperture problems .... See Entry 118052

Time domain solutions via integral equations—surfaces and composite bodies .... See Entry 118054

On using isoperimetric inequalities and isoperimetric quotients in electromagnetic theory and applied physics .... See Entry 118056

On the possibility of solving the boundary problem of the three-dimensional Poisson equation using a coherent optical processor .... See Entry 118086

One procedure for inverting the Laplace transformation in problems of interaction between nonstationary waves and a spherical inclusion .... See Entry 118320

Spatial problem for a deformable cone with a symmetrically disturbed surface .... See Entry 118397

A free boundary value problem in plate theory .... See Entry 118405

Mixed variational principle of creep theory in problems of long-term strength .... See Entry 118444

A varying-step algorithm for numerical integration of Takagi-Taupin equations .... See Entry 118941

On the dislocation fields in terms of the dynamic Green's function .... See Entry 119017

The singularity expansion method as applied to the elastodynamic scattering problem .... See Entry 120584

Improvement and testing of a variant of the seismoholographic Kirchhoff transformation .... See Entry 121158

02.40 GEOMETRY, DIFFERENTIAL GEOMETRY, AND TOPOLOGY

(see also 04. Relativity and gravitation)

116968 **ω-complete A-spaces.** Yu.L.Ershov.
Cybernetics (USA), vol.18, no.6, p.701-5 (Nov.-Dec. 1982). Translation of: *Kibernetika (USSR)*, vol.18, no.6, p.6-9 (Nov.-Dec. 1982). [received: Sept. 1983]
This article shows that a weaker condition of ω-completeness is sufficient for most of the results obtained for complete A-spaces. (6 refs.)

116969 **New method for calculating stable and unstable periodic orbits of one-dimensional maps.** H.Kaplan (Dept. of Phys., Syracuse Univ., Syracuse, NY, USA).
Phys. Lett. A (Netherlands), vol.97A, no.9, p.365-7 (26 Sept. 1983).
A new iterative method of calculating periodic orbits of one-dimensional maps is presented, based on a lemma of Metropolis, Stein and Stein (1973) with accelerated convergence based on Feigenbaum's scaling hypothesis (1978). The author is able to calculate global bifurcation diagrams, including unstable branches. (4 refs.)

Supergroups have no extra topology .... See Entry 116954

The geometric theory of deformation and linearization of Pfaffian systems and its applications to system theory and mathematical physics. I .... See Entry 116965

Extension of relativistic kinematics .... See Entry 116988

Topology and universality in the lattice CP^2 model .... See Entry 117313

Elements for a Lie-isotopic gauge theory .... See Entry 117319

Topological solitons and modulated structure of bases in DNA double helices: a dynamic plane base-rotator model .... See Entry 118024

Note on Euclidean Bianchi-type 'cosmologies' .... See Entry 121807

02.50 PROBABILITY THEORY, STOCHASTIC PROCESSES, AND STATISTICS

(see also 05. Statistical physics)

116970 **Maximum entropy formalism, fractals, scaling phenomena, and $1/f$ noise: a tale of tails.** E.W.Montroll, M.F.Shlesinger (Inst. for Phys. Sci. & Technol., Univ. of Maryland, College Park, MD, USA).
J. Stat. Phys. (USA), vol.32, no.2, p.209-30 (Aug. 1983).
The authors' examples of distribution functions with long tails; they (a) show that the derivation of distributions with inverse power tails from a maximum entropy formalism would be a consequence only of an unconventional auxiliary condition that involves the specification of the average value of a complicated logarithmic function, (b) review several models that yield log-normal distributions, (c) show that log normal distributions may mimic $1/f$ noise over a certain range, and (d) present an amplification model to show how log-normal personal income distributions are transformed into inverse power (Pareto) distributions in the high income range. (35 refs.)

Fractal dimensionality and the number of visited sites of the ant in the labyrinth .... See Entry 117080

The self-avoiding walk on the honeycomb lattice .... See Entry 117081

The application of Green's function to the investigation of the response of vehicle accelerating over random profile .... See Entry 117091

Markovian fluctuation-dissipation theory of open radiophysical systems .... See Entry 117092

Modified Monte-Carlo method to evaluate multiple scattering effects on light-beam transmission through a turbid atmosphere .... See Entry 118079

Optimal strength design of beam-columns .... See Entry 118398

Statistical theory of fibrous media. I. Longitudinal shear .... See Entry 118442

On the stability of linear stochastic systems with periodically nonstationary parametric excitation .... See Entry 118455

Planning and statistical processing of the results of tests for plotting quantile fatigue curves .... See Entry 120525

02.60 NUMERICAL APPROXIMATION AND ANALYSIS

116971 **An analysis of two-step time discretizations in the solution of the linearized shallow water equations.** M.G.G.Foreman (Inst. of Ocean Sci., Sidney, British Columbia, Canada).
J. Comput. Phys. (USA), vol.51, no.3, p.454-83 (Sept. 1983).
A Fourier analysis for evaluating the accuracy of finite element methods which solve the linearized shallow water equations is extended to include group velocity. The technique is first applied to the selection of a spatial discretization and then, assuming a specific finite element discretization, to finding the most accurate two-step time stepping method. (28 refs.)

Nonlinear inverse perturbation method in dynamic analysis .... See Entry 116973

Dynamical properties of many-dimensional solitons studied by numerical experiments .... See Entry 117006

New analysis methods in photon correlation spectroscopy .... See Entry 117244

A finite element quasi-Eulerian method for three-dimensional fluid-structure interactions .... See Entry 117678

Mathematical modelling for experimental physics data processing .... See Entry 117741

High-frequency fields excited by a line source located on a perfectly conducting concave cylindrical surface .... See Entry 118037

Some useful asymptotic and numerical techniques for solving high-frequency scattering problems .... See Entry 118062

Optimization of metal vapor lasers .... See Entry 118130

Matrix method for determining propagation characteristics of optical waveguides .... See Entry 118269

Nonlinear boundary value problem for the steady-state one-dimensional heat conduction equation .... See Entry 118355

The Idealized Structural Unit Method and its application to deep girder structures .... See Entry 118380

An axisymmetric Neumann potential problem for the circular annulus .... See Entry 118392

Numerical plastic shakedown analysis of plates and shells of revolution by equilibrium finite elements .... See Entry 118394

Nonlinear stress analysis of offshore pipelines during pickup operations .... See Entry 118411

Numerical optimum design of elastic annular plates with respect to buckling .... See Entry 118412

A finite element method for elastic-plastic beams and columns at large deflections .... See Entry 118430

A three-dimensional nonlinear analysis of cross-ply rectangular composite plates .... See Entry 118431

A curvilinear triangular finite element for plate bending by a hybrid method of assumed displacements supplemented with assumed stresses .... See Entry 118433

Solutions of singular problems of torsion of an elastic/ideally plastic rod .... See Entry 118446

Elasto-plastic buckling of stiffener plates in beam-to-column flange connections .... See Entry 118449

A modification of Potter's method for diagonal matrices with common unknown .... See Entry 118450

Stability and optimization of viscoelastic cylindrical shells made out of composites under combined loading .... See Entry 118453

On the stability of linear stochastic systems with periodically nonstationary parametric excitation .... See Entry 118455

Instability analysis of pressure-loaded thin arches of arbitrary shape .... See Entry 118461

Upper and lower bounds for energy-release rates in an elastic body .... See Entry 118505

Finite element analysis of steadily moving contact fields .... See Entry 118529

A numerical investigation for curved pipe flow at high Reynolds number .... See Entry 118679

Theoretical and numerical methods for quantitfying absorption patterns in man and animal bodies .... See Entry 120954

03.00 CLASSICAL AND QUANTUM PHYSICS; MECHANICS AND FIELDS

03.20 CLASSICAL MECHANICS OF DISCRETE SYSTEMS: GENERAL MATHEMATICAL ASPECTS

(for applied classical mechanics of discrete systems, see 46.10; for celestial mechanics, see 95.10)

116972 Time integration of the equations of motion of a structural system including damping. G.R.Heppler, J.S.Hansen (Univ. of Toronto, Toronto, Canada).
AIAA J. (USA), vol.21, no.9, p.1301-9 (Sept. 1983).
The conditions required to achieve the unconditional spectral stability for damped linear elastic structural systems are determined in closed form for several linear single-step implicit temporal operators. The results obtained include the effect of system damping on algorithmic damping, on relative period errors, and on the spectral radius of each operator. It is found that inclusion of systen damping results in more algorithmic damping in the low-frequency modes than in the high-frequency modes and it also causes a tendency to overshoot the exact response as compared to the undamped case. Based on the above, recommendations are made with regard to the choice of integration parameters for each operator. (17 refs.)

116973 Nonlinear inverse perturbation method in dynamic analysis. K.-O.Kim, W.J.Anderson, R.E.Sandstrom (Univ. of Michigan, Ann Arbor, MI, USA).
AIAA J. (USA), vol.21, no.9, p.1310-16 (Sept. 1983).
An analytical method is presented for the automated redesign of the model characteristics of undamped mechanical systems. The method is based on a perturbation of the eigensystem, and all nonlinear terms are carried so that large exchanges can be considered. The user requests frequency and mode shape changes. The structural changes are expressed through design parameters α_i representing conventional thicknesses, moments of intertia, etc. A penalty function method is used in which the original objective function is a minimum weight condition and the penalty term is a properly normalized set of residual nodal force errors. Solutions converge well for typical example problems using five cycles of the conjugate gradient method. The method is superior to linear methods, which have shown error when significant mode shape changes are required. It is believed to be computationally superior to series solutions, such as Taylor's series when only one or two frequencies and mode shapes are of interest. In addition, the method is not subject to a limited radius of convergence in the design variables as is encountered in series solutions. (15 refs.)

116974 Logicoalgebraic approach to Lagrangian systems. F.Barone, R.Grassini (Inst. of Math., Naples Univ., Naples, Italy).
Int. J. Theor. Phys. (USA), vol.22, no.9, p.829-36 (Sept. 1983).
A logicoalgebraic approach to the geometry of Lagrangian systems is pursued by starting axiomatically with a classical mechanical system whose logic is a separable and atomic Boolean σ algebra. (6 refs.)

116975 Monotonicity of energy eigenvalues for Coulomb systems. R.Eiglisch (Sektion Phys., Karl-Marx-Univ. Leipzig, Leipzig, Germany).
J. Phys. A (GB), vol.16, no.14, p.3179-91 (1 Oct. 1983).
Generalising results by Reed/Simon and Thirring, the author proves for a large class of Hamiltonians (among others, Hamiltonians of Coulomb systems) which can be written in the form $H(\alpha)=H_0+\alpha H'$ that their eigenvalues decrease with increasing α. The author applies this result to Coulomb systems in which the distances between the infinitely heavy particles are varying and also use it to obtain a completion and simplification of Adamowski et al.'s proof for the stability of the biexciton. (20 refs.)

116976 A new class of integrable systems. B.Dorizzi, B.Grammaticos (Dept. de Math., CNET, Issy les Moulineaux, France), A.Ramani.
J. Math. Phys. (USA), vol.24, no.9, p.2282-8 (Sept. 1983).
The authors present a family of dynamical systems associated with the motion of a particle in two space dimensions. These systems possess a second integral of motion quadratic in velocities (apart from the Hamiltonian) and are thus completely integrable. They were found through the derivation and subsequent resolution of the integrability condition in the form of a partial differential equation (PDE) for the potential. A most important point is that the same PDE was derived through considerations on the analytic structure of the singularities of the solutions ('weak-Painleve property'). (11 refs.)

116977 Integrability of Hamiltonians with third- and fourth-degree polynomial potentials. B.Grammaticos, B.Dorizzi (Dept. de Math., CNET, Issy les Moulineaux, France), A.Ramani.
J. Math. Phys. (USA), vol.24, no.9, p.2289-95 (Sept. 1983).
The weak-Painleve property, as a criterion of integrability, is applied to the case of simple Hamiltonians describing the motion of a particle in two-dimensional polynomial potentials of degree three and four. This allows a complete identification of all the integrable cases of cubic potentials. In the case of quartic potentials, although the results are not exhaustive, some new integrable cases are discovered. In both cases the integrability is explicited by a direct calculation of the second integral of motion of the system. (12 refs.)

116978 On the principle of virtual displacements. G.D.Blyumin.
Mech. Solids (USA), vol.17, no.6, p.19-24 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.22-8 (1982). [received: Oct. 1983]
The formulation of proof of the principle of virtual displacements is generalised to the case of nonstationary and nonholonomic constraints. The author gives examples of problems involving equilibrium of systems with such constraints. (7 refs.)

116979 On the theory of vibrational displacement with nonharmonic excitation. L.V.Bespalova, V.S.Metrikin.
Mech. Solids (USA), vol.17, no.6, p.30-4 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.34-9 (1982). [received: Oct. 1983]
Considers one problem in the theory of vibrational displacement, namely vibrational insertion (or extraction) of elements under the action of a periodic piecewise-continuous external force. Using the point-transformation method and the solution of the equations describing the dynamics of the process, the authors determine in general form the boundaries of the region of existence of the principal stable periodic motions. The general results obtained can be employed to investigate the dynamics of a system with an impulsive external force with arbitrary relative duration σ. All elementary periodic motions are investigated and exact analytic formulas given for their existence limits. This makes it possible to evaluate the effect of the parameters of the impulsive force on the dynamic characteristics of the process, in particular the effect of the relative duration σ on the optimal amount of insertion. (5 refs.)

116980 Opitmal control of periodic vibrations of a vibration-impact system. A.S.Kovaleva.
Mech. Solids (USA), vol.17, no.6, p.35-42 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.40-7 (1982). [received: Oct. 1983]
In dealing with problems of periodic optimization, the usual procedure is to write the differential equations of motion of the system, and to consider the periodicity conditions as additional constraints that relate the values of the generalized coordinates at the beginning and end of a period. Solution of these problems becomes much more complicated as the order of the system increases, and effective results have been obtained primarily for systems with one degree of freedom. The motion of a vibration-impact system can be described by one integral equation. To optimize periodic motions of vibration-impact systems the author employs methods used for systems described by integral equations. Some examples are also considered. (9 refs.)

116981 Discrete problem of synthesis of a system of strings. M.D.Dolberg, I.Yu.Chudinovich.
Mech. Solids (USA), vol.17, no.6, p.43-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.48-54 (1982). [received: Oct. 1983]
Deals with the problem of synthesizing a system of interconnected strings with concentrated masses, for which the squares of the vibrational frequencies coincide with the eigenvalues of a specified positive-definite matrix. The authors offer a parametrization of these systems that makes it possible to calculate the spans and masses in explicit form. The parametrization is convenient for solving a number of inverse problems, in particular the problem of reconstructing a system of connected strings on the basis of several spectra of vibrational frequencies, corresponding to different types of attachment of the string ends. (3 refs.)

116982 Many-body forces in directly interacting systems. T.Biswas, F.Rohrlich (Dept. of Phys., Syracuse Univ., Syracuse, NY, USA), M.King.
Nuovo Cimento B (Italy), vol.77B, ser.2, no.1, p.49-61 (11 Sept. 1983).
The conventional formulation of classical relativistic Hamiltonian constraint dynamics of N interacting particles assumes N constraints which are required to satisfy an Abelian Poisson-bracket algebra. This requirement imposes restrictions on the permitted interactions, resulting in many-body forces. These are difficult to compute for given two-body forces. The authors propose a perturbative method for this purpose, which is symmetric in the particles. It requires Poincare-invariant integration, which is discussed in detail. An example is solved explicitly. (14 refs.)

116983 Lagrangian mechanics of massless particles with spin. T.Shirafuji (Dept. of Phys., Saitama Univ., Saitama, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.18-35 (July 1983).
Lagrangian mechanics of massless particles with spin is studied, based on the interpretation that spin corresponds to displacement in complex directions. Starting with the action integral which ensures the masslessness of particles, two possibilities to introduce spin are investigated. In both cases, the equations of motions cannot fix the world line of massless spinning particles uniquely, due to a 'gauge' invariance property of the action integral. The space-time coordinates are not the most suitable for describing massless spinning particles, but it is convenient to take a pair of spinor variables, i.e. a twistor, as the basic dynamical variables to which the canoical quantization procedure can be applied. In one of the two cases, where massless particles are considered to move in superspace with N spinor coordinates it is found that massless particles form a spin (or helicity) multiplet with the helicity running from $-N/4$ to $+N/4$. (15 refs.)

116984 Necessary and sufficient conditions of reducibility of gauge degrees of freedom without using gauge conditions. R.Sugano (Dept. of Phys., Osaka City Univ., Osaka, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.36-50 (July 1983).
For dynamical systems described by singular Lagrangian, the conditions under which gauge degrees of freedom can be eliminated by transformations of variables are obtained within the framework of classical dynamics. All the systems whose gauge degrees of freedom are reducible without using gauge conditions may be classified into the following two cases. (i) A weakly reducible case; there exists a canonical transformation by which some of the gauge dependent variables in a Hamiltonian can be separated from other dynamical variables. Hence their gauge degrees of freedom can be completely isolated. (ii) A strongly reducible case; there is a point transformation by which the number of dynamical variables describing a Lagrangian (also a Hamiltonian) of a system can be reducible. Hence the corresponding gauge degrees of freedom are eliminated from the formula. Necessary and sufficient conditions for the reducibility are presented for each case. (9 refs.)

116985 Deliberations on the improvement of the computational model with measured eigenmagnitudes. H.G.Natke (Curt-Risch-Inst. of Vibration & Measurement Technol., Univ. of Hanover, Hanover, Germany).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.2, p.159-73 (March-April 1983). [received: Sept. 1983]
Up to now it has been usual to measure (identify) eigenmagnitudes of the associated undamped system and a damping ration of each degree of freedom of the system under test. In general these results are erroneous and incomplete. The question arises: what is to be done with these results besides a comparison with the corresponding magnitudes of the computational model? The answer will be discussed in the paper by means of three adjustment methods based on different measured data sets using the weighted least squares method as the estimation procedure. The adjustment is carried out with global factorial parameters of submatrices corresponding to subsystems. Indications are given with regard to applications. (12 refs.)

116986 The confinement of eigenvalues in the case of circular arc vibrations. J.Albrecht (Tech. Univ., Clausthal, Germany).
Z. Angew. Math. & Mech. (Germany), vol.63, no.8, p.387-9 (1983). In German.
The mathematical treatment is carried out on the basis of the Ritz method and Lehmann-Maehly method for the upper and lower limits respectively. Different classes of symmetry are considered and the calculated dependence of minimum eigenvalue on the variable parameter is shown. (9 refs.) *I.G.*

Analytical expression for the double-frequency Coulomb Green's function with explicitly separated singularities .... See Entry 117051

Fractal dimension of strange attractors from radius versus size of arbitrary clusters .... See Entry 117089

The application of Green's function to the investigation of the response of vehicle accelerating over random profile .... See Entry 117091

The response of multidegree-of-freedom systems with quadratic non-linearities to a harmonic parametric resonance .... See Entry 118382

Further studies on criteria for the onset of dynamical instability in general three-body systems .... See Entry 121509

The secular accelerations in Gylden's problem .... See Entry 121511

Motion near quadruple collision in the trapezoidal 4-body problem .... See Entry 121512

Determination of autonomous three-dimensional force fields from a two-parameter family of orbits .... See Entry 121513

Application of time reversal invariance to numerical experiments of many body systems: case of Campbell-Henon model .... See Entry 121517

03.30 SPECIAL RELATIVITY

116987 'Optical appearance' of a rolling ring. O.Gron (Inst. of Phys., Univ. of Oslo, Oslo, Norway).
Int. J. Theor. Phys. (USA), vol.22, no.9, p.821-7 (Sept. 1983).
The positions of the points on a rolling ring are calculated at retarded points of time, giving the 'optical appearance' of a rolling ring. (30 refs.)

116988 Extension of relativistic kinematics. T.Aaberge (Dept. de Phys. Theorique, Univ. de Geneve, Geneve, Switzerland).
Int. J. Theor. Phys. (USA), vol.22, no.9, p.851-65 (Sept. 1983).
The author gives an interpretation of the standard coordinates on Minkowski space-time that permits him to introduce an additional invariant time concept. He then considers an alternative set of coordinates and kinematical conservation laws on the resulting 'space-time'. Two conservation laws in addition to those of relativistic kinematics are obtained. The new conservation laws concern the quantities kinematical mass and mass defect, which have been introduced in order to have a more complete description of composite systems. (4 refs.)

116989 Special relativity in observer's time. S.Drobot (Dept. of Math., Ohio State Univ., Columbus, OH, USA).
J. Math. Anal. & Appl. (USA), vol.95, no.2, p.575-96 (Sept. 1983).
The special theory of relativity is reformulated in terms of the observer's time rather than of the proper time. This will make it possible not only to regain (even in a more general form) all known results of relativistic dynamics for a single particle interacting with an electro-magnetic field, but also to formulate the equations of motion for a system of particles interacting with each other and with their electromagnetic fields. This allows to prove conservation laws as first integrals of those equations. Moreover, the initial-value problem for those equations is well defined, although rather difficult to solve in view of the nonlinearity of the equations. (9 refs.)

116990 Fundamental equation of two body problem in relativistic analytical mechanics. N.Ionescu-Pallas (Nat. Center of Phys., Bucharest, Rumania), L.Sofonea.
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.2, p.103-22 (March-April 1983). [received: Sept. 1983]
A rigorous formulation of Invariantive Mechanics in the Hamiltonian version is given. the conditions concerning the inertial motion of the mass center and the mass-energy relationship are expressed by two equations with partial derivatives. An explicit form of the Hamiltonian function for a two body mechanical system is, finally, worked out in the first relativistic approximation. (4 refs.)

03.40 CLASSICAL MECHANICS OF CONTINUOUS MEDIA: GENERAL MATHEMATICAL ASPECTS

116991 Solvability of the Riquier problem for a biharmonic equation in a half-space and boundary conditions for the solutions. V.I.Gorbaichuk.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.9-13 (1983). In Ukrainian.
Theorems are established on solvability and solution uniqueness for the Riquier problem for a biharmonic equation in a half-plane. Inverse approximation theorems and estimates of solution derivatives are obtained for a tangential direction near the boundary. (9 refs.)

116992 The stability of biparametric damped oscillations. I.Misicu (Polytech. Inst., Bucharest, Rumania).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.3, p.261-9 (May-June 1983). [received: Sept. 1983]
The author analyses the vibrations corresponding to the biparametric equation of Hill type $d^2x/d\tau^2+(a+2b \cos 2\tau+2c \cos 4\tau)x=0$. The solutions are determined by means of trigonometric expansions. The neutral regions as well as the stability regions in the parametric space are plotted into diagrams using special programming and computerized calculus. The damping effects are also investigated. (12 refs.)

Reformulating classical and quantum mechanics in terms of a unified set of consistency conditions .... See Entry 117011

03.40D Mathematical theory of elasticity

(see also 46.20 Continuum mechanics, and 46.30 Mechanics of solids)

116993 Local energy decay for scattering of elastic waves. G.Dassios (Dept. of Math., Univ. of Patras, Patras, Greece).
J. Differ. Equations (USA), vol.49, no.1, p.124-41 (July 1983).
Shows that if $\mathcal{B}$ is a star-shaped body in R^3 and $\mathbf{u}$ is a solution of the equation of linearized homogeneous isotropic elasticity in the exterior of $\mathcal{B}$ which vanishes on $\partial\mathcal{B}$ and has initially compact support, then the rate of decay of the total elastic energy in any sphere of finite radius is bounded by t^{-1} for large values of the time t. (18 refs.)

116994 A note on the solutions of Boussinesq, Love, and Marguerre in axisymmetric elasticity. D.E.Carlson (Dept. of Theoretical & Appl. Mech, Univ. of Illinois, Urbana, IL, USA).
J. Elasticity (Netherlands), vol.13, no.3, p.345-9 (1983).
The author observes that by writing the displacement equation of equilibrium for homogeneous, isotropic, linear elasticity with zero body force in terms of the dilatation and rotation in the axisymmetric case, one is lead naturally to a complete solution in terms of two displacement potentials. This solution was noted previously by K. Marguerre (1955), but his derivation left its completeness in doubt. While the relationships between the displacement potentials and the displacement components in Marguerre's solution are especially simple, the partial differential equations satisfied by the potentials are coupled. Consequently, it is not surprising that this solution has attracted little attention. The present author uses it to provide economical completeness proofs for the well-known solutions of M. Boussinesq (1885) and A.E.H. Love (1927). (6 refs.)

116995 Rate forms of tensor field defined in nonlinear continuum mechanics. A.Makinouchi.
Rep. Inst. Phys. & Chem. Res. (Japan), vol.59, no.4, p.117-26 (1983). In Japanese.
In order to formulate the elastic-plastic constitutive relation at finite deformation, it is necessary to take a time derivative of the elastic part of constitutive relation which is referred to the plastically deformed configuration. Somewhat complicated kinematics of such a deformation make it difficult to choose a correct rate form of a tensor used in that constitutive relation. Geometrical significance of rate forms of vector field and tensor field including the corotational rate and the convected rate is discussed under a choice of orthonormal base vectors as the basis for three dimensional euclidian point space to give kinematical basis for the elastic-plastic constitutive relation. (12 refs.)

Regular solutions of wave equations containing nonlinearities of the type $L\Phi L$ .... See Entry 117003

On the equations of elastodynamics of bar mechanisms .... See Entry 118404

Generalised problem of thermoviscoelasticity of a layer under the action of a time-random stress-thermal field .... See Entry 118434

On the dissipation inequality in equilibrium shocks .... See Entry 118475

03.40K Waves and wave propagation: general mathematical aspects

(see also 46.30M Mechanical and elastic waves, 43.20 General linear acoustics)

116996 Head-on collisions between solitary surface waves on shallow water: theory and experiment. A.Mo, P.C.Hemmer.
Ark. Fys. Semin. Trondheim (Norway), no.9, p.1-15 (1983).
The interaction of two nonlinear solitary waves on shallow water, propagating in opposite directions, is studied by numerical integration of first-order shallow water equations. The nonlinear increment $n=s_{max}/(s_1+s_2)-1$, which compares the maximum amplitude s_{max} during the interaction, with the amplitudes s_1, s_2 of the separate pulses, is shown to be positive. The two-soliton solution of the Boussinesq equation, for which n is negative, thus gives an unsatisfactory account of head-on collisions of solitary waves on shallow water. The authors have also performed a water-tank experiment to compare laboratory data with the corresponding theoretical prediction. The agreement is satisfactory. (9 refs.)

116997 Diffraction of a planar wave by a structure consisting of an ideally rigid disc and a spherical mirror. S.S.Vinogradov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.53-7 (1983). In Ukrainian.
A rigorous solution is obtained for a problem on scalar wave diffraction by a perfectly rigid disc and spherical cap. The solution is expressed as the second type integro-summatory equation in $l_2\times L_2(0, \infty)$. The suggested approach is based on the Abelian integral transform. (8 refs.)

116998 Wave propagation near curvilinear boundaries of viscous piecewise homogeneous media. L.P.Shvets'.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.40-3 (1983). In Ukrainian.
A problem is formulated and studies are made on the influence of a viscous fluid and an elastic thin shell on the wave propagation near a cylindrical boundary in a peicewise homogeneous viscoelastic space. (7 refs.)

116999 Higher-order parabolic approximations to time-independent wave equations. J.P.Corones, R.J.Krueger (Dept. of Math., Iowa State Univ., Ames, IA, USA).
J. Math. Phys. (USA), vol.24, no.9, p.2301-4 (Sept. 1983).
A sequence of numerically tractable higher-order parabolic approximations is derived for the reduced wave equation in an inhomogeneous medium. The derivation is motivated by a definition of waves propagating in a distinguished direction. For a homogeneous medium these definitions are exact and yield uncoupled, infinite-order parabolic equations which are equivalent to the wave equation. The difficulty of obtaining higher-order parabolic approximations for the elastic wave equation in an inhomogeneous medium is also discussed. (6 refs.)

117000 Simple waves in quasilinear hyperbolic systems. I. Theory of simple waves and simple states. Examples of applications. A.M.Grundland (Dept. of Phys., Inst. of Geophys., Warsaw Univ., Warsaw, Poland), R.Zelazny.
J. Math. Phys. (USA), vol.24, no.9, p.2305-14 (Sept. 1983).
This paper presents a new method of construction of solutions to nonlinear, nonelliptic systems of partial differential equations and especially nonhomogeneous ones. These equations have been considered from the point of view of integral elements. In particular the connections between the structure of the set of integral elements and the possibility of a construction of special classes of solutions have been studied. These classes consist of what is called simple waves and k waves (for homogeneous systems) and simple states (in the case of nonhomogeneous systems). They provide the authors with a possibility for a selection of simple integral elements from the set of all integral elements. Analyses have been performed using differential forms and Cartan theory of system in involution. The problem has been reduced to examining Pfaff forms. The Cauchy problem for Pfaff systems has been formulated and solved using the Riemann function. Some remarks concerning the notion of Backlund transformations for the case of k waves have been formulated. It is shown that, in contrast to simple wave, the simple state has no gradient catastrophy. The technique presented of constructing the solutions in the form of simple states has been illustrated by the examples of Korteweg and de Vries and four-dimensional Klein-Gordon, sine-Gordon and Liouville equations. It has been shown that the known soliton equations are closely connected with the elliptical functions and especially with the P-Weierstrass functions. (36 refs.)

117001 Simple waves in quasilinear hyperbolic systems. II. Riemann invariants for the problem of simple wave interactions. A.M.Grundland (Dept. of Phys., Inst. of Geophys., Warsaw Univ., Warsaw, Poland), R.Zelazny.
J. Math. Phys. (USA), vol.24, no.9, p.2315-28 (Sept. 1983).
For pt.I see ibid., vol.24, p.2305 (1983). In this paper a generalization of the Riemann invariant method to the case of a nonhomogeneous system of equations has been formulated. The authors have discussed in detail the necessary and sufficient conditions for the existence of Riemann invariants. They perform the analysis using the apparatus of differential forms and Cartan theory of systems in involution. The problem has been reduced to examining Pfaff forms. They have considered the connections between the structure of the set of integral elements and the possibility of a construction of special classes of solutions depending on k arbitrary functions of one variable. These solutions can be interpreted physically as the interactions between k simple

waves on a simple state. They have proven that, in the case of interaction of many simple waves described by Riemann invariants, a conservation law for the type and quantity of waves holds. It has been also shown that such a solution, resulting from the interaction of many simple waves propagating on the simple state, decay for a large time in an exact way into simple waves (of the same kind as those entering the interaction) on the state. The Cauchy problem for the nonlinear superposition of k-sample waves has been formulated. A couple of theorems useful for this problem have been given in the Sec. III. The functional properties of the system of equations determining Riemann invariants have been described. The last part of the work contains an analysis of some examples of the solutions of nonhomogeneous magnetohydrodynamic equations from the point of view of the method described above. (27 refs.)

117002 Soliton solutions of the Korteweg de Vries and the Kadomtsev-Petviashvili equations: the Wronskian technique. N.C.Freeman, J.J.C.Nimmo (Dept. of Appl. Maths., Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).

Proc. R. Soc. London Ser. A (GB), vol.389, no.1797, p.319-29 (8 Oct. 1983).

The well known soliton solutions of the Kadomtsev-Petviashvili equations, (1970), are written in terms of determinants of Wronskian form. by using this compact representation together with the Horota bilinear form (1980) of the equations, it is demonstrated by elementary algebraic methods that the N-soliton solution satisfies the evolution equation and the N and N+1-soliton solutions satisfy the associated Backlund transformation. The relation of these results to the eigensolutions of the inverse scattering method and to the more usual representation of the N-soliton solution is also given. (7 refs.)

117003 Regular solutions of wave equations containing nonlinearities of the type $L\Phi L$. J.Weyer (Dept. Matematica, Univ. de Santiago de Chile, Santiago, Chile).

Proc. R. Soc. Edinburgh Sect. A (GB), vol.95, pt.1-2, p.147-52 (1983).

Regular solutions of the forced nonlinear wave equation $u_{tt}+L^4u+L\Phi Lu=r$ are studied in Hilbert spaces. L is a linear, positive, selfadjoint operator and the nonlinear nucleus $\Phi(u)=f(|u|^2)u$ is generated by a C^1-function f, such that $L\Phi(Lu)=f(|Lu|^2)L^2u$. If the initial value data $u(0)=\phi$ and $u_t(0)=\psi$ belong to the domain $D(L^{k+4})$ and $D(L^{k+2})$, respectively, and if $r\in D(L^k)$, then there is a (global) solution $u(t)$ such that $u\in D(L^{k+4})$, $u_t\in D(L^{k+2})$ and $u_{tt}\in D(L^k)$ for all times t. The abstract result is applied to examples in nonlinear elasticity theory. (15 refs.)

117004 Physical dynamics of solitons. M.J.Rice (Xerox Webster Res. Center, Webster, NY, USA).

Phys. Rev. B (USA), vol.28, no.6, p.3587-9 (15 Sept. 1983).

A collective-coordinate Hamiltonian is derived for a sine-Gordon or ϕ^4 soliton. It describes a material particle whose translational motion is coupled to an internal degree of freedom. The Hamiltonian equations of motion are solved for exactly and show that the 'soliton' may exist in a dynamical state of constant translational momentum and constant total energy with an internal vibration which imparts an oscillatory component to the soliton's translational velocity. (6 refs.)

Local energy decay for scattering of elastic waves ....See Entry 116993

Dynamical properties of many-dimensional solitons studied by numerical experiments ....See Entry 117006

The isospectral property for a family of non-self-adjoint operators ....See Entry 117026

The inverse scattering problem for perturbed wave equations ....See Entry 117050

Canonical quantization of the sine-Gordon system in the multisoliton sector ....See Entry 117353

Topological solitons and modulated structure of bases in DNA double helices: a dynamic plane base-rotator model ....See Entry 118024

Properties of a wave field in a semi-infinite elastic cylinder (boundary resonance) ....See Entry 118479

03.50 CLASSICAL FIELD THEORY

117005 Finite-parameter solution classes for the two-body problem with delay. V.I.Zhdanov.

Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.13-15 (1983). In Ukrainian.

Solutions of motion equations with delay are studied. They form a family of solutions of a certain system of ordinary differential equations. The results are applied to a two-body problem in classical electrodynamics. (6 refs.)

117006 Dynamical properties of many-dimensional solitons studied by numerical experiments. A.B.Shvachka.

In *Collection of scientific papers in collaboration with joint Institute for Nuclear Research, Dubna, USSR and Central Research Institute for Physics, Budapest, Hungary. Algorithms and programs for solution of some problems in physics. Vol.IV*, p.71-84. Report KFKI-1983-21, Hungarian Acad. Sci., Budapest (1983), 191 pp.

The brief review of the dynamical properties of many-dimensional quasi-solitons studied by means of the computer simulation in the framework of the nonlinear classical field theory models is presented. It is shown that the types of soliton interactions are model independent for studied models. (16 refs.)

A comprehensive study of the yield of Cerenkov radiation in transparent media ....See Entry 117725

Electromagnetic and acoustic resonance scattering theory .....See Entry 118047

03.65 QUANTUM THEORY; QUANTUM MECHANICS

(see also 05.30 Quantum statistical mechanics; for relativistic wave equations, see 11.10)

117007 Quantum tunnelling in a dissipative system. A.O.Caldeira (Univ. Estadual de Campinas, Sao Paulo, Brazil), A.J.Leggett.

Ann. Phys. (USA), vol.149, no.2, p.374-456 (Sept. 1983).

The authors consider the effect of dissipation on quantum tunnelling. It is found that the presence of dissipation causes suppression, and the suppression factor is studied for linear dissipation. The results are applied to the tunnelling of a macroscopic variable, such as the trapped flux in a SQUID. (66 refs.)

117008 Quantum mechanics and macroscopic separability: a critical review. J.L.Sanchez-Gomez, J.M.Sanchez-Ron (Dept. de Fisica Teorica, Univ. Autonoma de Madrid, Madrid, Spain).

An. Fis. Ser. A (Spain), vol.79, no.2, p.85-94 (May-Aug. 1983). [received: Oct. 1983]

The authors discuss the consequences of the Einstein-Podolsky-Rosen theorem concerning the non-separable nature of reality as implied by quantum mechanics. A critical review of several experiments and theoretical ideas dealing with said subject is presented. (62 refs.)

117009 Discrete quantum mechanics. R.Friedberg, T.D.Lee (Columbia Univ., New York, NY, USA).

Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B225(FS9), no.1, p.1-52 (3 Oct. 1983).

Recently the possibility was raised that time can be regarded as a dynamical variable. This leads to the formulation of discrete mechanics, with the usual continuum mechanics appearing as an approximation. The difference between these two is examined in this paper. (8 refs.)

117010 Examples of Schrodinger's equation with singular potentials. II. A.M.Eishinskii (Vecernjaja Skola, Dnjepropetrovsk, SSSR).

Fizika (Yugoslavia), vol.15, no.3, p.311-20 (July-Sept. 1983). In Russian.

For pt.I see ibid., vol.13, p.163 (1981). Two examples of one-dimensional Schrodinger equation with strongly singular potentials are considered and solutions vanishing at the origin are constructed using the well-known transcendental functions. (11 refs.)

117011 Reformulating classical and quantum mechanics in terms of a unified set of consistency conditions. R.F.Bordley (Univ. of Michigan, Dearborn, MI, USA).

Int. J. Theor. Phys. (USA), vol.22, no.9, p.803-20 (Sept. 1983).

The author imposes consistency conditions on the path of a particle and shows that they imply Hamilton's principle in classical contexts and Schrodinger's equation in quantum mechanical contexts. The author provides a common, intuitive foundation for classical and quantum mechanics. It also provides a very new perspective on quantum mechanics. (13 refs.)

117012 Coupling of quantum logics. S.Pulmannova (Math. Inst., Acad. of Sci., Bratislava, Czechoslovakia).

Int. J. Theor. Phys. (USA), vol.22, no.9, p.837-50 (Sept. 1983).

A quantum logic is a couple (L, M), where L is a logic and M is a quite full set of states on L. A tensor product in the category of quantum logics is defined and a comparison with the definition of free orthodistributive product of orthomodular σ lattices is given. Several physically important cases are treated. (10 refs.)

117013 The multigrid method for accelerated solution of the discretized Schrodinger equation. F.F.Grinstein, H.Rabitz, A.Askar (Dept. of Chem., Princeton Univ., Princeton, NJ, USA).

J. Comput. Phys. (USA), vol.51, no.3, p.423-43 (Sept. 1983).

The use of the new multigrid method for the numerical solution of the discretized Schrodinger equation is discussed. A simple approach is chosen to circumvent the difficulties associated with the fact that the Schrodinger differential operator is not positive definite. The scheme is applied to a two-dimensional model problem which includes the essential features present in actual scattering problems. The results show that significant savings can be achieved both in computational work and core memory requirements. The multigrid method should greatly increase the utility of meshing procedures for solving the partial differential equations of quantum mechanics. (19 refs.)

117014 Accurate calculation of the eigenvalues of the $x^2+\lambda x^2/(1+gx^2)$ potential. F.M.Fernandez, A.M.Meson, E.A.Castro (INIFTA, La Plata, Argentina).

J. Comput. Phys. (USA), vol.51, no.3, p.519-26 (Sept. 1983).

The authors present an alternative procedure for calculating the eigenvalues of the Schrodinger equation with potential $V(x)$ where $V(x)=x^2+\lambda x^2/(1+gx^2)$. (15 refs.)

117015 The eigenvalues of the bounded λx^{2m} oscillators. R.N.Chaudhuri (Phys. Dept., Visva-Bharati Univ., Santiniketan, India).

J. Phys. A (GB), vol.16, no.14, p.3193-6 (1 Oct. 1983).

The even- and odd-parity eigenvalues of the bounded pure λX^{2m} oscillators are obtained as the roots of two equations derived explicitly. (24 refs.)

117016 Collective rotations of asymmetrically deformed many-body systems. II. Intrinsic symmetry effects. L.F.Lathouwers (Univ. of Antwerp, Antwerp, Belgium).

J. Phys. A (GB), vol.16, no.14, p.3197-205 (1 Oct. 1983).

For pt.I see ibid., vol.15, no.9, p.2785-79 (1982). The implications of intrinsic symmetries on the structure of rotational secular equations in the angular momentum projection formalism are studied for both the exact and approximate versions. The symmetry group of the rigid rotor, D_2, is used to illustrate formal results. (11 refs.)

117017 Separation of centre-of-mass motion for a charged two-body system in a homogeneous magnetic field. D.Baye (Phys. Theorique et Math., Univ. Libre de Bruxelles, Brussels, Belgium).

J. Phys. A (GB), vol.16, no.14, p.3207-18 (1 Oct. 1983).

Exact centre-of-mass separation is performed for the problem of a charged two-body system in a homogeneous magnetic field. Common eigenstates of three exact and approximate constants of motion are constructed in the creation and annihilation operator formalism. Their expression as an infinite series in coordinate representation is obtained using two real linear canonical transformations. An expansion of the wavefunction in this eigenstate basis provides an infinite system of differential equations for the relative motion. This system of equations differs from the infinite nucleus mass approximation by the existence of small terms which couple states with different values of the magnetic quantum number. The usual limitation of the number of electron Landau states leads to a finite number of coupled equations. (19 refs.)

117018 Oscillatory structure of the harmonic oscillator Wigner function. N.Rowley (Niels Bohr Inst., Copenhagen, Denmark).

J. Phys. A (GB), vol.16, no.14, p.3219-36 (1 Oct. 1983).

Some simple closed-form approximations are derived for the oscillatory part of the Wigner function F for a system of degenerate fermions completely filling the first M shells of an oscillator potential in N dimensions. The formalism for a general dimensionality is retained since various properties of the physical case ($N=3$) may be related to similar systems in one dimension higher or lower. In particular the magnitude of the oscillations increases with N, but it is shown that if the last shell is only half filled the structure is decreased to that obtained for a closed-shell system in one dimension lower. The structure is shown to decrease slowly in the 'classical' or 'macroscopic' limit of large particle number, when the density is shown to tend to its Thomas-Fermi value. The formula for the full-shell case is sufficiently simple to generalise to the problem of almost degenerate fermions at a finite temperature T, where it is seen that substantial damping of the oscillations may be obtained for any particle number. An explicit expression for the damping is derived and this implies that for deep-inelastic nuclear reactions at a temperature of around 2 to 3 MeV, considerable structure may still be present in *F*. A simple expression relating the Fermi energy and the particle number of the system at finite temperature is given. (19 refs.)

117019 Harmonic oscillator with variable mass. P.G.L.Leach (Dept. of Appl. Math., La Trobe Univ., Bundoora, Australia).
J. Phys. A (GB), vol.16, no.14, p.3261-9 (1 Oct. 1983).
A general treatment of the quantal harmonic oscillator with variable mass is given. Various examples additional to those obtained by Colegrave and Abdalla for which a closed form solution is possible are given. (11 refs.)

117020 Algebraic quantisation with indefinite metric. P.Broadbridge (Dept. of Math. Phys., Univ. of Adelaide, Adelaide, Australia).
J. Phys. A (GB), vol.16, no.14, p.3271-90 (1 Oct. 1983).
A real symplectic flow may be viewed as being pseudo-unitary, provided there exists a symplectic complex structure *J* which commutes with it. The author determines the class of dynamical systems for which *J* exists. Such systems may be quantised algebraically but the state space may have indefinite metric. This procedure admits a larger class of classical systems than does Segal's algebraic quantisation but there are problems in interpreting the indefinite metric and these are listed and discussed. (34 refs.)

117021 A class of exact solutions for anharmonically coupled oscillators. J.Makarewicz (Inst. of Chem., A Michiewicz Univ., Poznan, Poland).
J. Phys. A (GB), vol.16, no.15, p.L553-7 (21 Oct. 1983).
The author studies the solutions of the two-dimensional Schrodinger equation for anharmonically coupled oscillators. The author obtains a finite set of exact solutions of the form $\psi(x,y)=$polynomial (x,y) exp(polynomial (x,y)) provided that certain constraints on the potential parameters are satisfied. (28 refs.)

117022 On the dynamic symmetry of the stationary Schrodinger equation. L.V.Poluyanov, A.I.Voronin (Inst. of Chem. Phys., Acad. of Sci., Moscow, USSR).
J. Phys. A (GB), vol.16, no.15, p.3409-20 (21 Oct. 1983).
The symmetry of the two- and three-dimensional Schrodinger equation is analysed in terms of second-order differential operators which commute with the Hamiltonian of the solutions of the stationary Schrodinger equation. A set of equations for the coefficients of the symmetry operators is formulated and a general form for the structure of the symmetry operators is obtained. Symmetry operators have been found for the cases of some potentials. The effect of the symmetry raising at zero energy is described. (9 refs.)

117023 Sum rules for harmonic-oscillator brackets. S.Shlomo (Dept. of Phys., Texas A&M Univ., College Station, TX, USA).
J. Phys. A (GB), vol.16, no.15, p.3463-9 (21 Oct. 1983).
A new class of sum rules is derived for the coefficients of the Talmi transformation of the harmonic-oscillator wavefunctions from the single particle coordinates to the relative and the centre-of-mass coordinates. (11 refs.)

117024 Extension of the perturbational-variational Rayleigh-Ritz formalism to large order. J.N.Silverman (Max-Planck-Inst. fur Strahlenchem., Mulheim, Germany).
J. Phys. A (GB), vol.16, no.15, p.3471-83 (21 Oct. 1983).
The previously derived peturbational-variational Rayleigh-Ritz (PVRR) matrix formalism for calculating the Rayleigh-Schrodinger (RS) perturbation series of the normal modes of astrophysical and other classical systems is greatly strengthened so as to make it a powerful tool for applying large-order perturbation theory to the study of both classical and quantum mechanical eigenvalue problems; the underlying generalised Sturm-Liouville type perturbed eigenvalue equation is encountered in many branches of physics. The original formalism is first modified by introducing a number of auxiliary matrixes which render it amenable to the recursive calculation of the RS series of eigenvalues, eigenvectors, and related expectation values. It is then extended to large perturbational order by deriving and incorporating the generalised PVRR remainder and Hellmann-Feynman theorems: these PVRR matrix theorems include the corresponding RS quantum mechanical theorems as special cases. The resultant modified and extended formalism is applicable to an arbitrary Rayleigh-Ritz (linear variational) Ansatz and enables, in a single computer run, the accurate recursive calculation to extremely high perturbational order of the PVRR series of all eigenstates. (43 refs.)

117025 Non-associative properties of a deformed Poisson product and the quantisation problem. C.N.Ktorides, L.C.Papaloucas (Univ. of Athens, Athens, Greece).
J. Phys. A (GB), vol.16, no.15, p.3485-92 (21 Oct. 1983).
The authors discuss the associativity properties of a deformed algebra of phase-space functions, the deformation taken to finite order. They assess the findings in view of a recently proposed quantisation scheme which admits non-associative algebras of operators. They draw a number of conclusions pertaining to the applicability of the deformed algebra for quantum mechanical descriptions. (8 refs.)

117026 The isospectral property for a family of non-self-adjoint operators. H.M.A.de Castro (Inst. de Matematica, Univ. de Sao Paulo, Sao Paulo, Brazil), W.F.Wreszinski.
J. Math. Phys. (USA), vol.24, no.9, p.22787-81 (Sept. 1983).
Proves the isospectral property for certain families of linear non-self-adjoint operators which play a role in inverse scattering theory for a class of nonlinear evolution equations of interest in physics. These include the sine-Gordon and nonlinear Schrodinger equations. (20 refs.)

117027 Generalized stochastic processes and continual observations in quantum mechanics. G.Lupieri (Istituto di Fisica, Univ. di Milano, Milano, Italy).
J. Math. Phys. (USA), vol.24, no.9, p.2329-39 (Sept. 1983).
Gives here a mathematically rigorous form to an earlier work by Barchielli, Lanz, and Prosperi (1982), in which it was found that a generalized stochastic process describes the results of continual observations of the position of a quantum particle. With the help of Albeverio and Hoegh-Krohn's theory (1976) of Feynman path integrals, the author defines the characteristic functional of this process and demonstrates that it possesses the necessary properties of normalization, continuity, and positive definiteness. An explicit calculation of the Feynman path integral which defines the functional allows an analysis of the process to be made. (11 refs.)

117028 Operators for the two-dimensional harmonic oscillator in an angular momentum basis. O.Odundun (Phys. Dept., Univ. of Ife, Ile-Ife, Nigeria).
J. Math. Phys. (USA), vol.24, no.9, p.2340-4 (Sept. 1983).
The forms of the operators $\nu^\dagger,\nu,\lambda^\dagger,\lambda$, which enable one to write the Hamiltonian of the two-dimensional isotropic harmonic oscillator in the form $H=\hbar\omega(2\nu^\dagger\nu+\lambda^\dagger.\lambda+1)$, are presented. Here $\nu^\dagger$ and ν are respectively, the raising and lowering operators for $\nu^\dagger\nu$, the 'radial' quantum number operator, while $\lambda^\dagger$ and λ are, respectively, the raising and lowering operators for *M*, the magnitude of the angular momentum operator. Corresponding to this decomposition of *H* in the angular momentum basis are the energy eigenvalues $E_{km}=\hbar\omega(2k+|\mathrm{m}|+1)$ with $k=0,1,2,\ldots$ and $m=0,\pm1,\pm2,\ldots$. Here *k* is a 'radial' quantum number and *m* is a 'magnetic' quantum number. The commutation relations satisfied by the operators $\nu^\dagger,\nu,\lambda^\dagger$, and λ are also presented. (3 refs.)

117029 A time-dependent Schrodinger equation. H.U.Kranold (Nuclear Dev. Corp. of SA Ltd., Pretoria, S Africa).
J. Math. Phys. (USA), vol.24, no.9, p.2345-7 (Sept. 1983).
Reduces the solution of the Schrodinger equation with the potential $U(r,t)=\alpha_1(t)\mathrm{r}^2+\alpha_2(t)x+\alpha_3(t)y+\alpha_4(t)z+\alpha_5(t)$ to the solution of the Schrodinger equation for a free particle. The $\alpha_i(t)$ are arbitrary functions of time. A generalization of this is also considered. (3 refs.)

117030 *N*-body quantum scattering theory in two Hilbert spaces. III. Theory of approximations. C.Chandler, A.G.Gibson (Univ. of New Mexico, Albuquerque, NM, USA).
J. Funct. Anal. (USA), vol.52, no.1, p.80-105 (1 June 1983).
For pt.II see J. Math. Phys., vol.19, p.1610-16 (1978). A rigorous mathematical theory of approximations is developed for abstract nonrelativistic quantum scattering systems within the two-Hilbert-space framework. An approximate space of asymptotic states and an approximate asymptotic Hamiltonian must be specified initially. An approximate *N*-particle Hamiltonian is then constructed and proved to be self-adjoint. Approximate wave operators are shown to exist and, in certain intereresting cases, to be asymptotically complete. Certain sequences of the approximate wave operations are proved to converge to the exact wave operators in an approximate limit. Thus approximate scattering operators are unitary and converge to the exact scattering operator. (23 refs.)

117031 Propagation properties of quantum scattering states. V.Enss (Inst. for Math., Ruhr-Univ., Bochum, Germany).
J. Funct. Anal. (USA), vol.52, no.2, p.219-51 (15 June 1983).
The change of localization of a scattering state under free and interacting time evolutions for quantum mechanical potential scattering is derived. If a particle of mass *m* is localized in a ball of radius *R* and has energy below $mv^2/2$, then at time *t* the component of the state in the 'forbidden region' $|x|>R+vt$ decays integrably in time. Various sharper estimates for the free time evolution are also derived. The momentum support of a state in terms of its full energy support in regions where the potential is weak is controlled. The potential may be fairly general and of short or long range. (11 refs.)

117032 Krein's formula and one-dimensional multiple-well. J.M.Combes, P.Duclos (Univ. de Toulon et du Var, Marseille, France), R.Seiler.
J. Funct. Anal. (USA), vol.52, no.2, p.257-301 (15 June 1983).
It is shown that all the discrete eigenvalues of a one-dimensional Schrodinger operator with a multiple well potential possess an asymptotic expansion in power of $\hbar^{1/2}$ when $\hbar\rightarrow0$. A formula for all the coefficients of these expansions is given. The method uses two main tools: Perturbation by boundary conditions and exponential decay of eigenfunctions which are developed in this article. As a byproduct of this work, the exponential localization of eigenvectors when ħ goes to zero can be proved. (21 refs.)

117033 Borel summability of divergent Born series. L.Lovitch (Istituto di Fisica, Univ. di Ferrara, Ferrara, Italy), M.F.Marziani.
Nuovo Cimento A (Italy), vol.76A, ser.2, no.4, p.615-26 (21 Aug. 1983).
The Borel summability method is applied to summing diverging Born series obtained from the Lippmann-Schwinger equation for the two-body *T*-matrix with the $^1S_0$ Reid potential. It is found, in practice, that appreciable numerical difficulties prevent its direct application. However, a combination of the first confluent form of the ϵ-algorithm of Wynn with the Borel method is shown to yield a rapidly converging solution of the scattering equations of comparable accuracy to other standard methods. (20 refs.)

117034 Solution of two paradoxes in the quantum theory of unstable systems. M.Bunge (McGill Univ., Montreal, Quebec, Canada), A.J.Kalnay.
Nuovo Cimento B (Italy), vol.77B, ser.2, no.1, p.1-9 (11 Sept. 1983).
Two apparent paradoxes in the quantum theory of unstable systems are discussed and solved. According to one of them all decay processes, regardless of their mechanism, would be exponential under certain very general assumptions. According to the other an unstable system will never decay, provided it is kept under constant observation. The paradoxes are shown to derive from the tacit classical assumption that every unstable thing is always either in the undecayed or in the decayed state. They do not occur as long as the superposition principle is taken seriously and the system is conceived as being normally in a superposition of sharp states. Moreover, the decay is shown to be a continuous process that unfolds regardless of the observations to which the decay products may be subjected. (19 refs.)

117035 Real successive measurements on unstable quantum systems take nonvanishing time intervals and do not prevent them from decaying. M.Bunge (McGill Univ., Montreal, Quebec, Canada), A.J.Kalnay.
Nuovo Cimento B (Italy), vol.77B, ser.2, no.1, p.10-18 (11 Sept. 1983).
An alarming result has been derived in the theory of unstable systems by considering a sequence of instantaneous observations. According to it, continued observation prevents decay. The authors show that this paradox is avoided if the fiction of the instantaneous observation is replaced with the realistic hypothesis that a measurement (hence the corresponding reduction of the wave packet) takes a nonvanishing time interval. They derive the corresponding formulae, first for a single measurement on a single unstable system, then for a sequence of measurements. Actually the results hold not only for measurements but for interactions of all kinds. The upshot is that the lifetime of an unstable system, while depending on its interactions with a second system, cannot be prolonged arbitrarily by mere continued observation. And in any event such a life span is an objective property of the system under investigation. (11 refs.)

117036 Role of certain gradient vector fields in quantum mechanics. M.Nishioka (Dept. of Phys., Faculty of Liberal Arts, Yamaguchi Univ., Yamaguchi, Japan).
Nuovo Cimento B (Italy), vol.77B, ser.2, no.1, p.19-30 (11 Sept. 1983).
Using the complex wave function satisfying the Schrodinger equation the author defines gradient vector fields which will be used to rewrite the quantum-mechanical formulae such as the Schrodinger equation, the continuity equation and the canonical communication relations. With these formulae rewritten by the gradient vector fields, the author obtains correspondence among the quantum-mechanical formulae and the current and the stochastic velocities, the Fokker-Planck equations, the left and right derivatives which Nelson (1967) used for the stochastic quantization. The author makes some comments on the Schrodinger equation in case that a force proportional to the current or to the stochastic velocity is exerted. Next the relativistic case is treated in which, by making use of the complex wave function satisfying the Klein-Gordon equation, gradient vector fields are defined. They play a central role in expressing several important formulae which have close analogy with some formulae appeared in the relativistic Brownian motion. Finally the author studies the Lagrangian density of a massive real scalar field minimally coupled to the gradient vector fields. (7 refs.)

117037 Yes-no experiments and ordered structures in quantum physics. C.Garola, L.Solombrino (Dipartimento di Fisica, Univ. di Lecce, Lecce, Italy).
Nuovo Cimento B (Italy), vol.77B, ser.2, no.1, p.87-110 (11 Sept. 1983).
The authors consider the set E of all the yes-no experiments that can be performed on a given physical system and the related posets $(\mathcal{E},\leq)$ and the 'effects' and $(\mathcal{L},<)$ of the 'propositions', illustrate by means of examples the relations $\leq$ and $<$ and give counterexamples for properties that one might suspect to hold in $(\mathcal{E},<)$; in particular, they show that Mackey's axiom V (1963) does not usually hold either in $(\mathcal{E},\leq)$ or in its greatest subposet $(\mathcal{E}_0,\leq)$ which can be orthocomplemented with standard methods in quantum logic. Following on the suggestions arising from the examples, they associate with every observable T, by means of the concept of 'efficiency', a family E_T of yes-no experiments, hence a family $\mathcal{E}_T$ of effects parametrized by the Borel fuzzy sets on the real line, and show that the description of the effects by means of operators, which is usual in some axiomatic approaches, can be recovered in standard Hilbert-space quantum theory as an immediate consequence of simple, 'intuitive' assumptions on E. This description is used in order to explicitly display (possibly in the presence of superselection rules) some properties of the representations of $(\mathcal{E},\leq)$ and $(\mathcal{L},<)$, and the links between some different axiomatic approaches (in particular, Makey and Piron, 1976). Finally, they point out some mathematical properties of the lattice of the operators that describe $\mathcal{E}_T$. (22 refs.)

117038 Non-perturbative solution of the Bloch-Mathieu Hamiltonian system. Ming-De Dong (Inst. of Theoretical Phys., Acad. Sinica, Beijing, China).
Phys. Lett. A (Netherlands), vol.97A, no.7, p.275-9 (12 Sept. 1983).
A non-perturbative wavefunctions is obtained for the Bloch-Mathieu Hamiltonian system. The explicit expression of the Floquet exponent indicates that the wavefunction depends non-analytically on E and quadratically on V_1, both demonstrating the illegitimacy of the perturbation expansion. The energy band is also given by an analytic expression instead of Kramers' indirect construction. (3 refs.)

117039 On the joint measurement of incompatible observables in quantum mechanics. W.M.De Muynck, J.M.V.A.Koelman (Dept. of Theoretical Phys., Eindhoven Univ. of Technol., Eindhoven, Netherlands).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.1-4 (3 Oct. 1983).
Starting from a representation of a quantum-mechanical observable by a positive-operator-valued measure it is derived that if two incompatible observables $\mathcal{A}$ and $\mathcal{B}$ are measured jointly then both the $\mathcal{A}$- and the $\mathcal{B}$-measurement are disturbed. More specific: if the expectation values $\langle\mathcal{A}\rangle$ and $\langle\mathcal{B}\rangle$ are undisturbed then there is a broadening in the probability distributions of both the $\mathcal{A}$- and the $\mathcal{B}$-measurement results. (4 refs.)

117040 Local realism has not been refuted by atomic cascade experiments. T.W.Marshall (Dept. of Math., Manchester Univ., Manchester, England), E.Santos, F.Selleri.
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.5-9 (3 Oct. 1983).
The authors obtain a local realistic model, involving just one angular hidden variable, giving predictions, for the coincidence counts in atomic cascade experiments, which come extremely close to those of the quantum-mechanical model, and which fit the experimental data as closely as do the predictions of that model. (19 refs.)

117041 Vortex, spin and triad for quantum mechanics of spinning particle. I. General theory. T.Takabayasi (Dept. of Phys., Nagoya Univ., Nagoya, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.1-17 (July 1983).
It is shown that a natural extension of the hydrodynamical formalism of quantum mechanics for a Schrodinger particle to include vortical flows leads to the hydrodynamical formalism of quantum mechanics for a spinning particle. This latter formalism is then analysed in regard to its characteristic features, especially the subsidiary condition connecting the vorticity of flow with the inhomogeneity of spin field and the existence of spin stress. Also the formalism is brought to completion by establishing the global condition that quantizes circulation around a singular vortex line. The geometro-hydrodynamical formalism which is equivalent to the above hydrodynamical formalism but introduces a triad structure underlying the classical spin is reconstructed on its own footing. The geometrical property of the triad implies the invariance of theory with respect to the rotation of each triad around its symmetry axis by an arbitrary angle, and this necessitates the introduction of the electromagnetic potential, providing the geometrical interpretation of local gauge invariance. Applications of theory to various special cases and typical examples are deferred to Part II. (15 refs.)

117042 Density dynamics: a generalization of Hartree-Fock theory. D.J.Rowe, M.Vassanji (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada), G.Rosensteel.
Phys. Rev. A (USA), vol.28, no.4, p.1951-6 (Oct. 1983).
The authors show that to any Lie algebra of observables in quantum mechanics there corresponds a system of densities, of which the one-body densities are just one example. These densities may correspond to a single pure state or to an ensemble of states. Like the one-body densities, they support a Hamiltonian dynamics of the time-dependent Hartree-Fock type, which can be applied, for example, to collective motions where the collective states of interest may be either more or less general than single Slater determinants. The dynamics can also be applied to the average dynamics of an ensemble of states. (6 refs.)

117043 Quantum states of two particles on concentric spheres. G.S.Ezra, R.S.Berry (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
Phys. Rev. A (USA), vol.28, no.4, p.1989-2000 (Oct. 1983).
The model of two particles on a sphere is extended to two particles on concentric spheres (POCS). The quantum states are found for two electrons, one on a sphere of radius 10 a.u. (simulating the shell $n=3$ in He) and the other, on spheres of 10, 15, 25, 50, and 100 a.u. The eigenvalues and densities $\rho(\theta_{12})$ exhibit a transition from collective, moleculelike behavior to independent-particle-like behavior with Russell-Saunders coupling. The parallel problem of two particles with electron masses interacting via a repulsive Gaussian potential is also treated and a similar transition from collective to independent-particle behavior found. The principal difference between the two cases is only the region of radius of the larger sphere where the transition occurs. (18 refs.)

117044 Quantum nondemolition measurements via quadratic coupling. G.J.Milburn, D.F.Walls (Phys. Dept., Univ. of Waikato, Hamilton, New Zealand).
Phys. Rev. A (USA), vol.28, no.4, p.2065-70 (Oct. 1983).
The authors consider making quantum nondemolition measurements on a harmonic oscillator by coupling it to an oscillator readout system using a four-wave-mixing interaction. The quantum nondemolition variable of interest appears as a nonlinear function of the number operator. It has the form $D_1(t)=\cos(\chi a^{\dagger}at)$. A sequence of measurements of this operator may be made with completely predictable results. The possible use of this system to detect gravitational radiation is suggested. (10 refs.)

117045 L^2-lower bounds to solutions of one-body Schrodinger equations. R.Froese, I.Herbst (Inst. Mittag-Leffler, Djursholm, Sweden), M.Hoffmann-Ostenhof, T.Hoffmann-Ostenhof.
Proc. R. Soc. Edinburgh Sect. A (GB), vol.95, pt.1-2, p.25-38 (1983).
The asymptotic behaviour of L^2-solutions of one-body Schrodinger equations $(-\Delta+V-E)\psi=0$ in $\Omega_R=\{x\in R^n \mid |x|>R\}$ is investigated. The authors show, for example, that if V tends to zero in a certain sense for $|x|\rightarrow\infty$, then either $|x|^{\gamma}\exp\left(\sqrt{(\max(0,-E))}|x|\right)\psi\notin L^2(\Omega_R)$ for some $\gamma>0$ or ψ has compact support. Related results are given for potentials tending to infinity for $|x|\rightarrow\infty$. (18 refs.)

117046 Bloch waves and multiparameter spectral theory. B.P.Rynne, B.D.Sleeman (Dept. of Math. Sci., Univ. of Dundee, Dundee, Scotland).
Proc. R. Soc. Edinburgh Sect. A (GB), vol.95, pt.1-2, p.73-93 (1983).
The authors study the spectral theory of a multiparameter system of periodic Schrodinger operators. Bloch waves are generalized eigenfunctions of these operators and are used to give eigenfunction expansion theorems and to derive some properties of the spectrum of the system. (15 refs.)

117047 Polarization of a bound particle having a large angular moment. A.M.Dmitriev.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.74-8 (Aug. 1983). In Russian.
Splitting of the l-level of a particle bound by an arbitrary central potential is shown to coincide with character of splitting of the three dimensional rotator level with radii r_l of the order of the pit dimension. Dependence of r_l on l and the binding energy of the particle is discussed. (3 refs.)

117048 Quantum particle energy levels asymptotics in electrical and strong magnetic fields. S.N.Solnyshkin.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.78-80 (Aug. 1983). In Russian.
Quantum particle motion is considered in electrical and homogeneous magnetic fields. The asymptotics of energy levels in high magnetic fields is obtained. These results are applied to the hydrogen molecular ion. (9 refs.)

117049 Quantum scattering and scattering of electromagnetic waves by unbounded obstacles. E.M.Il'yin.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.80-2 (Aug. 1983). In Russian.
The problem of asymptotic completeness in scattering by unbounded obstacles is studied. Two cases of electromagnetic wave scattering are investigated as well as quantum scattering of three particles in the hard core model. (3 refs.)

Nonlinear quantum dynamical semigroups for many-body open systems ....See Entry 117076

Solutions to the Schrodinger equation on some fractal lattices ....See Entry 117117

One-dimensional exactly integrable dynamical systems (classical and quantum regions) ....See Entry 117332

Equivalence of stochastic quantization method to conventional field theories through super transformation invariance ....See Entry 117345

Gauge fixing condition as non-holonomic constraint in stochastic quantization of non-abelian gauge fields ....See Entry 117346

Canonical quantization of the sine-Gordon system in the multisoliton sector ....See Entry 117353

Semiclassical quantization of the complex sine-Gordon field theory ....See Entry 117354

Ground-state wave-function 'representation' ....See Entry 117378

A class of simple Hamiltonians with degenerate ground state. II. A model of nuclear rotation: Spontaneous breakdown of rotation symmetry and Goldstone theorem for finite dimensional system ....See Entry 117529

Atoms in circularly polarised fields: the dilation-analytic approach ....See Entry 117848

03.80 GENERAL THEORY OF SCATTERING

(see also 11.20 S-matrix theory, and 11.80 Relativistic scattering)

117050 The inverse scattering problem for perturbed wave equations. P.L.Trudinger (Dept. of Pure Maths., Univ. of Sydney, Sydney, Australia).
Arch. Ration. Mech. & Anal. (Germany), vol.81, no.3, p.245-77 (1983).
The inverse problem in scattering theory is the problem of characterising the scatterer from knowledge of the scattering operator. The author shows how the convex hull of the support of the scatterer may be recovered for two systems characterized by the equations $u_{tt}=\Delta u-qu$ and $u_{tt}=a\nabla.b\nabla u$ in $\mathbf{R}^3$. Here a and b are taken to be smooth positive functions, and q is square integrable. (11 refs.)

117051 Analytical expression for the double-frequency Coulomb Green's function with explicitly separated singularities. S.O.Shadchin, V.F.Kharchenko.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.59-62 (1983). In Ukrainian.
A problem is considered on the off-shell Coulomb scattering of two particles. A new analytical expression for the two-particle Coulomb Green's function with explicitly separated singularities in variables of the transferred momentum and energy is obtained in the case of negative energy. (12 refs.)

117052 L^2 discretization and complex coordinates in the calculation of bound-free amplitudes in the presence of long-range forces. B.R.Johnson (Dept. of Chem., Univ. of Colorado, Boulder, CO, USA), W.P.Reinhardt.
Phys. Rev. A (USA), vol.28, no.4, p.1930-44 (Oct. 1983).
The formalism of Moller wave operators is shown to provide a stable basis for computation of bound-free transition amplitudes for both short- and long-range potentials without the direct calculation of scattering wave functions. This method, which relies on the techniques of expansion in finite L^2 bases and rotation of the coordinates into the complex plane, is applied to both an exponential potential and one that behaves asymptotically as $-1/r^4$. It is demonstrated that one obtains not only accurate magnitudes of the matrix elements, but accurate phases (i.e. the scattering phase shift) as well. Some relevant theoretical results with regard to the application of wave operators are also presented. Although couched in terms of potential scattering, the procedures are readily extendible to multichannel problems. (58 refs.)

117053 Application of the theory of generalized rays to diffractions of transient waves by a cylinder. Y.H.Pao, G.C.C.Ku (Dept. of Theoretical & Appl. Mech., Cornell Univ., Ithaca, NY, USA), F.Ziegler.
Wave Motion (Netherlands), vol.5, no.4, p.385-98 (Aug. 1983).
The theory of generalized rays was developed to analyze transient waves in layered media where incident circular or spherical waves are reflected and

refracted by plane boundaries. The theory has been recently extended to analyze the diffraction of transient waves by a spherical or a cylindrical boundary. The generalized ray integrals, which represent the Fourier transformed diffracted waves, are formulated for the diffraction of an incident spherical pulse by a circular cylinder. The ray integral involves a double integration with respect to two variables of wave slowness. Through a simultaneous transformation of variables, the inverse Fourier transform of these double integrals are completed by applying the Cagniard method. (12 refs.)

117054 Space-time integral equation solution for hard or soft targets in the presence of a hard or soft half space. C.L.Bennett, H.Mieras (Systems Applications, Sperry Res. Center, Sudbury, MA, USA).
Wave Motion (Netherlands), vol.5, no.4, p.399-411 (Aug. 1983).
The responses of a hard or soft target in the presence of a hard or soft half space are computed using space-time integral equations formulated in the time domain. The incident pressure wave is a 'smoothed impulse' with a Gaussian-shaped time dependence, whose width is of the order of a target dimension. A space-time integral equation; for the pressure field and the gradient pressure field on the outside of the target surface is solved for the pressure and the pressure gradient by stepping on in time. The scattered field is then computed from these source fields. The technique is applicable to targets of arbitrary contour and is demonstrated for a sphere and right-circular cylinder at various locations relative to the half space. (7 refs.)

The scattering of two Yang-Mills plane waves .... See Entry 117322

04.00 RELATIVITY AND GRAVITATION

(for special relativity, see 03.30; for relativistic astrophysics, see 95.30; for relativistic cosmology, see 98.80)

04.20 GENERAL RELATIVITY

(see also 02.40 Geometry and topology)

117055 The optical scalars in Kerr-Schild-type spacetimes. B.C.Xanthopoulos (Dept. of Phys., Univ. of Crete, Iraklion, Greece).
Ann. Phys. (USA), vol.149, no.2, p.286-95 (Sept. 1983).
The optical scalars are defined and the optical equations are derived for a null, geodesic, but not necessarily affinely parametrized, vector field. The optical scalars are left invariant under the action of a Kerr-Schild transformation $\hat{g}_{ab}=g_{Ab}+l_a l_b$. The optical equations are integrated explicitly in Kerr-Schild spacetimes. As an application, the search for Kerr-Schild-type N spacetimes with twisting rays is formulated. (14 refs.)

117056 On the exterior solutions of a charged mass point in gauge theories of gravitation. Y.Z.Zhang (Inst. of Theoretical Phys., Acad. Sinica, Peking, China).
Commun. Theor. Phys. (China), vol.2, no.3, p.1161-3 (1983).
In a case of spherically symmetric and static fields, exterior solutions of a charged mass point for the nine-parameter $R+R^2$ gravitational theories are investigated. The author finds that in the case of the coupling constant $(2p-2r+s)=0$, the solution without torsion is the Reissner-Nordstrom metric, but otherwise there is no solution with vanishing torsion. (4 refs.)

117057 A new interior solution of Einstein's field equations for a spherically symmetric perfect fluid in shear-free motion. H.Stephani (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
J. Phys. A (GB), vol.16, no.15, p.3529-32 (21 Oct. 1983).
Although spherically symmetric expanding (or contracting) stars are a very important class of objects for the application of general relativity theory, only very few perfect fluid solutions of Einstein's equations have been found so far. A new class of exact solutions is presented which contains two arbitrary functions of time and one additional parameter. (4 refs.)

117058 On rotating charged dust in general relativity. V. J.N.Islam (Dept. of Maths., City Univ., London, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1797, p.291-8 (8 Oct. 1983).
For pt. IV see ibid vol.385, p.189, (1983). Finds an exact cylindrically symmetric stationary exterior solution of the Einstein-Maxwell equations. The author then matches this solution smoothly onto an interior solution for rotating charged dust found earlier by the author. The solution thus obtained is regular and well behaved inside the matter. Such matched solutions are rare either for the Einstein or Einstein-Maxwell equations. Some properties of the solution are discussed. (9 refs.)

Fluctuations in the general relativistic theory of fluids and solids .... See Entry 117059

Instantons in Kaluza-Klein theories .... See Entry 117062

Obtaining charged particles as singularities in a topologically nontrivial Kaluza-Klein world .... See Entry 117063

Locally Kahler gravitational instantons .... See Entry 117064

The influence of quantum effects on the space-time structure in the neighbourhood of singularities in the general theory of relativity .... See Entry 121796

The cosmological problem as initial value problem on the observer's past light cone: geometry .... See Entry 121799

Cosmology from higher-dimensional gravity .... See Entry 121805

Note on Euclidean Bianchi-type 'cosmologies' .... See Entry 121807

04.30 GRAVITATIONAL WAVES AND RADIATION: THEORY

An alternate derivation of radiation in an inflationary universe .... See Entry 121806

04.40 CONTINUOUS MEDIA; ELECTROMAGNETIC AND OTHER MIXED GRAVITATIONAL SYSTEMS

117059 Fluctuations in the general relativistic theory of fluids and solids. N.Salie, R.Wulfert, W.Zimdahl (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
J. Phys. A (GB), vol.16, no.15, p.3533-43 (21 Oct. 1983).
A formalism to describe small random fluctuations in general relativistic continuous media is presented. It is based on the scheme of general relativistic irreversible thermodynamics and follows the lines of the non-relativistic theory of hydrodynamic fluctuations by Landau and Lifshitz (1957, 1966). In a natural way Einstein's field equations and the equation of motion take a form which in principle allows one to calculate the mean behaviour and the correlation functions of any physical quantity of the theory. As an example fluctuations of a long thin bar under the influence of weak gravitational fields are treated. (19 refs.)

A new interior solution of Einstein's field equations for a spherically symmetric perfect fluid in shear-free motion .... See Entry 117057

On rotating charged dust in general relativity. V .... See Entry 117058

The influence of quantum effects on the space-time structure in the neighbourhood of singularities in the general theory of relativity .... See Entry 121796

Gravitational instability for a multifluid medium in an expanding universe .... See Entry 121801

04.50 UNIFIED FIELD THEORIES AND OTHER THEORIES OF GRAVITATION

117060 Comments on the Rainich-Misner-Wheeler theory in Euclidean gravity. M.Przanowski (Inst. of Phys., Tech. Univ. Lodz, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.9, p.663-9 (Sept. 1983).
The 'already unified field theory' of the electromagnetic and gravitational fields with a cosmological term on a four-dimensional Riemannian manifold with a positive definite metric is proposed. (9 refs.)

117061 'What God hath put asunder, let no man join together'. The grand unification problem. H.-J.Treder (Einstein Lab., Potsdam-Babelsberg, Germany).
Astron. Nachr. (Germany), vol.304, no.4, p.145-51 (1983). In German.
Reviews attempts which have been made to combine the gravitational and electromagnetic fields into a single physical theory. Mentions the ideas of Lorentz, Einstein, Eddington, Weyl, Heisenberg and Pauli, and includes a comment by Lenin. The unification problem in this form remains unsolved. (29 refs.) *G.F.F.*

117062 Instantons in Kaluza-Klein theories. S.M.Barr (Dept. of Phys., Univ. of Washington, Seattle, WA, USA).
Phys. Lett. B (Netherlands), vol.129B, no.5, p.303-6 (29 Sept. 1983).
In a six-dimensional theory of gravity the author finds an instanton solution to Einstein's equations. The extra two dimensions are compactified into a sphere, S^2. Within a Kaluza-Klein ansatz the theory thus reduces at long distance to an SO(3) gauge theory in four dimensions. These solutions are the analogues of the BPST instantons. The existence of such solutions in six-dimensional gravity is a consequence of the conformal properties of the BPST instanton. (7 refs.)

117063 Obtaining charged particles as singularities in a topologically nontrivial Kaluza-Klein world. Hong-Mo.Chan, A.J.Murphy, SheungTsun.Tsou.
Report RL-83-070, Rutherford Appleton Lab., Chilton, Oxon., England (Aug. 1983), 10 pp.
By relaxing the Kaluza-Klein ansatz of a compactified fifth dimension from a global to a local requirement, one is led to a world where space-time automatically admits topological singularities characterised by a conserved and quantised charge. By virtue merely of their topological nature, these singularities acquire an interaction with the Einstein-Maxwell field which is to all appearances identical to that of a classical charged particle. (7 refs.)

On the exterior solutions of a charged mass point in gauge theories of gravitation .... See Entry 117056

On rotating charged dust in general relativity. V .... See Entry 117058

Testing general relativity: 20 years of progress .... See Entry 117069

The cosmological evolution of general Bianchi models in the adiabatic regime .... See Entry 121800

04.60 QUANTUM THEORY OF GRAVITATION

117064 Locally Kahler gravitational instantons. M.Przanowski (Inst. of Phys., Tech. Univ., Lodz, Poland), B.Broda.
Acta Phys. Pol. B (Poland), vol.B14, no.9, p.637-61 (Sept. 1983).
The authors discuss certain properties of locally Hermitian and locally Kahlerian manifolds. It is shown that a manifold is locally Hermitian iff some of its spinorial connection coefficients vanish. Conditions of a similar type are obtained for locally Kahlerian manifolds. Subsequently, locally Kahler-Einstein gravitational instantons are investigated. Their vacuum Einstein equations with the cosmological term have been reduced locally to a single nonlinear equation of the second order for one real function. This, in turn, has enabled the authors to show that any locally Kahler gravitational instanton with $R=-4\Lambda=$const. admits locally a real, source-free Maxwell field which for a Kahler gravitational instanton appears to be global. In the latter case, the Einstein-Maxwell equations have been reduced locally to a single differential equation of the fourth order for one real function. (41 refs.)

117065 Dynamical implementation of the gravitons as Nambu-Goldstone bosons. H.Saller (Max-Planck-Inst. fur Phys. und Astrophys., Munchen, Germany).
Nuovo Cimento A (Italy), vol.76A, ser.2, no.4, p.663-84 (21 Aug. 1983).
General relativity can be considered as a theory with a nonlinear realization of the symmetry $GL_{4,R}$. In analogy to the Nambu-Jona-Lasinio (1961) chiral model, it is shown how the massless gravitons arise in the pair approximation. The ultraviolet divergences of the canonical approaches can be avoided by using fields with anomalous dimensions. Such an approach is suggested by the fact that the tetrads contain also the dilatation Goldstone field which affects the dimensions of the fields involved. The characteristic mass for the $GL_{4,R}$ condensation proves to be the Planck mass, which in turn is also related to the most dangerous consequence of the subcanonical structure, the indefinite metric in state space. The dynamical incorporation of gravity shows a way to determine, by finite gap equations, the ratios of the characteristic masses for the internal breakdowns (e.g. chirality of SU_2) to the Planck mass. (19 refs.)

On the exterior solutions of a charged mass point in gauge theories of gravitation .... See Entry 117056

Instantons in Kaluza-Klein theories .... See Entry 117062

04.65 SUPERGRAVITY

117066 Supersymmetry and non-compact groups in supergravity. J.Ellis (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA), M.K.Gaillard, M.Gunaydin, B.Zumino.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.3, p.427-50 (19 Sept. 1983).
The authors study the interplay of supersymmetry and certain non-compact invariance groups in extended supergravity theories (ESGTs). They use the

$N=4$ ESGT to demonstrate that these symmetries do not commute and exhibit the infinite-dimension superinvariance algebra generated by them in the global limit. Using this result, they look for unitary representations of the full algebra. They discuss the implications of the results of the context of attempts to derive a relativistic effective gauge theory of elementary particles interpreted as bound states of the $N=8$ ESGT. (50 refs.)

117067 Seven-spheres from octonions and geometric torsion. J.Lukierski, P.Minnaert (Lab. de Phys. Theorique, Univ. de Bordeaux I, Gradignan, France).

Phys. Lett. B (Netherlands), vol.129B, no.6, p.392-6 (6 Oct. 1983).

The groups SO(7), Spin 7 and three inequivalent representations of the O(8) algebra [two spinorial Spin^R 8, Spin^L 8 and vectorial SO(8) related by a triality relation]. The authors are realized as transforations on the octonionic sphere S^7. The authors consider the coset Spin $7/G_2$ describing S^7 with geometric torsion and three Riemannian S^7: one vectorial [SO(8)/SO(7)] and two spinorial ($\mathrm{Spin}^L 8$/Spin 7, $\mathrm{Spin}^R 8$/Spin 7). Using two non-canonical choices of the connections on Spin $7/G^2$ one obtains either the torsionless $S^7=SO(8)/SO(7)$ or the parallelizable curvatureless seven-sphere. (30 refs.)

Supergroups have no extra topology ....See Entry 116954

Experimental signals for supersymmetric decays of the W and Z bosons ....See Entry 117379

W decay in supergravity GUTs ....See Entry 117380

de Sitter QED ....See Entry 117404

04.80 EXPERIMENTAL TESTS OF GENERAL RELATIVITY AND OBSERVATIONS OF GRAVITATIONAL RADIATION

117068 Characteristics of low frequency cryogenic antennas for gravitational radiation. S.Owa, K.Tsubono, H.Hirakawa (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).

Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L452-4 (July 1983).

Characteristics of low frequency mechanical antennas for gravitational radiation are presented. The problems arising from the very long relaxation time and the transducer noise are discussed. (9 refs.)

117069 Testing general relativity: 20 years of progress. C.M.Will (Washington Univ., St. Louis, MO, USA).

Sky & Telesc. (USA), vol.66, no.4, p.294-9 (Oct. 1983).

Discusses from an historical perspective tests on general relativity. The foundations of gravitational theory are discussed. Classical tests and tests of the strong equivalence principle are discussed. Finally the author describes tests for gravitational radiation. (2 refs.)

Quantum nondemolition measurements via quadratic coupling ....See Entry 117044

05.00 STATISTICAL PHYSICS AND THERMODYNAMICS

(see also 02.50 Probability theory, stochastic processes, and statistics)

05.20 STATISTICAL MECHANICS

117070 Relation between the kinetic method and the correlation-function method for the self-diffusion coefficient. J.L.Cruz (Facultad de Ciencias, Cordoba, Spain), F.Romero, J.Cotrino.

An. Fis. Ser. A (Spain), vol.79, no.2, p.100-5 (May-Aug. 1983). [received: Oct. 1983]

The authors develop a kinetic method to obtain formal expressions, for transport coefficients within the Brussel's group formalism and more specifically within the matrix representation of Liouville's equation introduced by Balescu (1971) which is sufficiently well developed and whose utility has been repeatedly proved. (8 refs.)

117071 Influence of box shape on the hard-disk pressure at high fluid density. W.Schreiner, K.W.Kratky (Inst. fur Experimentalphys., Univ. Wien, Wien, Austria).

Chem. Phys. (Netherlands), vol.80, no.3, p.245-51 (15 Oct. 1983).

The finiteness effects induced by periodic boundary conditions are examined for a hard-disk fluid. Besides the relatively simple N dependence there is a more complicated V dependence. Three different approaches are displayed and contrasted: (i) A rough estimate for the V dependence of the pressure, based on a theoretical equation of state. (ii) a more detailed and expensive treatment of the V dependence by a method due to Pratt and Haan (1981). (iii) MC simulations, intending to evoke V dependence deliberately. The influence of varying box shape and particle number ($N=71$, 72 and 73) is investigated. All simulations have been carried out for high fluid density (packing fraction$=0.648$). Finally, the consistency of these approaches is discussed. (14 refs.)

117072 Generating functional for large-kernel distribution functions in nonequilibrium statistical systems in the region of intense thermal fluctuations. O.A.Grechanii.

Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.44-8 (1983). In Ukrainian.

A statistical approach is developed to describe a kinetic stage of evolution of nonequilibrium statistical systems with intensive large-scale thermal fluctuations. The approach is based on a construction of the Bogolyubov equation solution with respect to a generating functional that uses a boundary condition of partial correlation weakening. (9 refs.)

Kinetic mean field theories: Results of energy constraint in maximizing entropy ....See Entry 117131

05.30 QUANTUM STATISTICAL MECHANICS

(see also 67. Quantum fluids, and 71. Electron states in condensed matter)

117073 The Fermi-hypernetted-chain method for many-body systems. B.Arntsen, E.Ostgaard.

Ark. Fys. Semin. Trondheim (Norway), no.10, p.1-79 (1983).

The great interest in many-body systems and their physical properties has lead to a strong development of new theories and calculation methods for such problems. A well-known perturbation theory is the Brueckner theory where one starts from the linked Rayleigh-Schrodinger perturbation expansion. The Brueckner theory, however, does not work properly for large densities, and it is developed mainly for Fermi system. Pandharipande (1971, 1973) has, therefore, suggested a method of lowest-order constrained variation (LOCV) which should work for large densities and for Bose systems. The LOCV method is a variational method for the energy. In the LOCV method a 'power-series' expansion for the energy is terminated after the first (two-body cluster) term, which is not well founded on theoretical grounds. To include higher-order terms, the authors consider the Fermi-hypernetted-chain (FHNC) method, which is developed analogously to the hypernetted-chain (HNC) method for classical gases. (21 refs.)

117074 The simulation of quantum systems with random walks: a new algorithm for charged systems. D.Ceperley (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).

J. Comput. Phys. (USA), vol.51, no.3, p.404-22 (Sept. 1983).

Random walks with branching have been used to calculate exact properties of the ground state of quantum many-body systems. A more general Green's function identity is derived which relates the potential energy, a trial wavefunction, and a trial density matrix to the rules of a branched random walk. It is shown that an efficient algorithm requires a good trial wavefunction, a good trial density matrix, and a good sampling of this density matrix. An accurate density matrix is constructed for Coulomb systems using the path integral formula. The random walks from this new algorithm diffuse through phase space an order of magnitude faster than the previous Green's Function Monte Carlo method. In contrast to the simple diffusion Monte Carlo algorithm, it is an exact method. Representative results are presented for several molecules. (19 refs.)

117075 Derivation of the Boltzmann equation for a Fermi gas. N.M.Hugenholtz (Inst. for Theoretical Phys., Univ. of Groningen, Groningen, Netherlands).

J. Stat. Phys. (USA), vol.32, no.2, p.231-54 (Aug. 1983).

The author considers the time evolution of a Fermi gas with two-body interaction. For an initial state ρ which is translation invariant and sufficiently clustering the author puts $H=H_0+\lambda V$, takes the limit $\lambda \rightarrow 0$, $t \rightarrow \infty$ such that $\lambda^2 t=\tau$ and shows that (a) the limiting state ρ_τ does not depend on the p-point correlations of ρ for $p>2$, (b) ρ_τ has vanishing p-point correlations for $p>2$, and (c) the two-point function that determines ρ_τ satisfies the Boltzmann equation. To avoid nonessential technical difficulties, the author considers the case of a Fermi gas on a lattice. (6 refs.)

117076 Nonlinear quantum dynamical semigroups for many-body open systems. R.Alicki, J.Messer (Sektion Phys., Univ. Munchen, Munchen, Germany).

J. Stat. Phys. (USA), vol.32, no.2, p.299-312 (Aug. 1983).

The notion of a nonlinear quantum dynamical semigroup is introduced, and the existence and uniqueness of solutions of the corresponding nonlinear evolution equations are studied in a more abstract framework. The construction of nonlinear quantum dynamical semigroups is carried out for two different mean-field models. First a mean-field coupling between a system of noninteracting subsystems and the bath is investigated. As examples, a nonlinear frictional Schrodinger equation and a model for a quantum Boltzmann equation are discussed. Second, a many-body system with mean-field interaction coupled to a bath is considered. Here, again, the form of the generator is derived; however, it cannot be obtained rigorously, except for some particular examples. Finally, the quantum Ising-Weiss model is briefly studied. (26 refs.)

117077 A Schwinger variational method for the Bloch equation. P.A.Whitlock, M.H.Kalos (Courant Inst. of Math. Sci., New York Univ., New York, NY, USA), G.V.Chester.

J. Stat. Phys. (USA), vol.32, no.2, p.389-405 (Aug. 1983).

A Schwinger variational principle has been derived for use in quantum many-body systems at finite temperatures. The variational principle is a stationary expression for the density matrix which may be iterated to improve an approximate density matrix. It also can be used to find stationary expressions for observables. If an approximate, parametrized density matrix is used, the parameters are varied to find the regions where the variational principle is stationary. The variational density matrix obtained with the optimal parameters can be regarded as optimal for that observable. The method has been applied to two model problems, a particle in a box and two hard spheres at finite temperature. The advantages and shortcomings of the method are discussed. (9 refs.)

117078 Can the velocity autocorrelation function decay exponentially?. M.H.Lee (Dept. of Phys., Univ. of Georgia, Athens, GA, USA).

Phys. Rev. Lett. (USA), vol.51, no.14, p.1227-30 (3 Oct. 1983).

For Hermitian many-body systems, admissable functions for the velocity autocorrelation function form a certain invariant of time. This property originates from a basic recurrence relation. The exponentially decaying function cannot form an invariant and therefore cannot be admissible. (23 refs.)

05.40 FLUCTUATION PHENOMENA, RANDOM PROCESSES, AND BROWNIAN MOTION

117079 Oblique sequential plans for finite-state Markov processes. V.T.Stefanov (Inst. of Maths., Bulgarian Acad. of Sci., Sofia, Bulgaria).

C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.6, p.759-60 (1983).

Investigates an M-state Markov process with an unknown intensity matrix. The oblique sequential plans for the process are discussed. For every reasonable subset of the whole natural parametric space. (3 refs.)

117080 Fractal dimensionality and the number of visited sites of the ant in the labyrinth. R.B.Pandey, D.Stauffer (Inst. of Theoretical Phys., Cologne Univ., Koln, Germany).

J. Phys. A (GB), vol.16, no.14, p.L511-13 (1 Oct. 1983).

Monte Carlo studies in three dimensions confirm the hypothesis of Toulouse and Rammal that the number of distinct sites visited by a random walk on a random network at its percolation threshold varies as $(\mathrm{time})^{2/3}$. (13 refs.)

117081 The self-avoiding walk on the honeycomb lattice. J.Adler (Phys. Dept. & Solid State Inst., Technion-Israel Inst. of Technol., Haifa, Israel).

J. Phys. A (GB), vol.16, no.14, p.L515-17 (1 Oct. 1983).

The author analyses the chain generating function for the self-avoiding walk problem on the honeycomb lattice. She uses the exact critical point value of Nienhuis and finds exponent values of $\gamma \sim 1.344$ and $\Delta_1 \sim 0.93$ for the dominant and first confluent exponents. The former value is in agreement with Nienhuis' exact result. Second and third confluent exponents, $\Delta_2 \sim 1.2$ and $\Delta_3 \sim 1.5$, are also identified, these exponents being consistent with Monte Carlo results and Nienhuis' exact irrelevant eigenvalue, respectively. (12 refs.)

117082 Stochastic aspects in the theory of spectral-line broadening. I. Collision time statistics and *N*-perturber limit. G.C.Hegerfeldt, R.Reibold (Inst. fur Theoretische Phys., Univ. Gottingen, Gottingen, Germany).
J. Stat. Phys. (USA), vol.32, no.2, p.313-35 (Aug. 1983).
An atom in a gas or plasma experiences a random potential which gives rise to the so-called pressure broadening. The corresponding line shape is obtained in the usual two-level model by a trace operation from the Fourier transform of $\langle T(t,0)\rangle$, the average of the time-development operator. Under certain technical assumptions it is rigorously shown by probabilistic techniques that $\langle T(t,0)\rangle$ falls off faster than $t^{-3+\epsilon}$ for any $\epsilon>0$, giving a continuous Fourier transform and line shape. An alternative expression is derived for the latter which explicitly displays its positivity and which is a limit over increasing perturber numbers. The latter generalized results of von Waldenfels (1973). (16 refs.)

117083 Stochastic aspects in the theory of spectral-line broadening. II. Noncommutative cluster expansions. G.C.Hegerfeldt, R.Reibold (Inst. fur Theoretische Phys., Univ. Gottingen, Gottingen, Germany).
J. Stat. Phys. (USA), vol.32, no.2, p.337-60 (Aug. 1983).
For pt.I see ibid., vol.2, no.2, p.313-35 (1983). Generalizing ideas of von Waldenfels (1973), the authors develop a systematic procedure to define truncated *n*-point operators which are reminiscent of Ursell functions of statistical mechanics. The truncation procedure is adapted to factorization relations obeyed by the operators in question. The results are applied to spectral-line broadening in plasmas. They derive cluster expansions for the line-shape function in terms of these truncated operators, where the ions are treated quasistatistically. The first order approximation for the line-shape function is discussed. The results are carried over to several moving perturber species, in particular to nonquasistatic ions. (5 refs.)

117084 Shape dependence of correlation times in chaos-induced diffusion. S.Grossmann (Fachbereich Phys., Philipps-Univ., Marburg, Germany), S.Thomae.
Phys. Lett. A (Netherlands), vol.97A, no.7, p.263-7 (12 Sept. 1983).
A one-dimensional discrete-time chaotic system generating a diffusive process with strong correlations between successive steps is considered, as realized in brownian motion with directional persistence (observed e.g. for the motion of infusoriae). The resulting intermittency-like behavior without $1/f$ spectrum may be found in many nonlinear systems with two metastable states. (16 refs.)

117085 Relaxation of systems under the effect of a Gaussian white noise. Kolmogorov backward equation method. K.Kitahara (Inst. fur Festkorperforschung, KFA Julich GmbH, Julich, Germany), K.Ishii.
Prog. Theor. Phys. (Japan), vol.70, no.1, p.312-14 (July 1983).
Exact and explicit results are obtained for the relaxation of a class of nonlinear systems under the effect of a Gaussian white noise with the method of the Kolmogorov backward equation. (15 refs.)

117086 Resistance of random walks. J.R.Banavar, A.Brooks-Harris, J.Koplik (Schlumberger-Doll Res., Ridgefield, CT, USA).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1115-18 (26 Sept. 1983).
Unrestricted lattice random walks in which a unit conductor is placed along each bond traversed are considered. The mean end-to-end resistance is studied as a function of the number of steps in the walk and the spatial dimension. A critical scaling law is found whose exponent is consistently given by four different calculational schemes. (14 refs.)

117087 Formation of fractal clusters and networks by irreversible diffusion-limited aggregation. P.Meakin (Central Res. & Dev. Dept., E.I. du Pont de Nemours & Co., Wilmington, DE, USA).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1119-22 (26 Sept. 1983).
A model for diffusion-controlled aggregation in which growing clusters as well as individual particles are mobile has been investigated. Two versions of the model in which the cluster diffusion coefficient is either size independent or inversely proportional to number of particles (mass) give very similar results. In the limit of low concentration and large system size both models lead to the structures with a fractal (Hausdorff) dimensionality of about 1.45-1.5 in two-dimensional lattice-based simulations. (19 refs.)

117088 Novel superuniversal behavior of a random-walk model. H.E.Stanley, K.Kang, S.Redner, R.L.Blumberg (Dept. of Phys., Boston Univ., Boston, MA, USA).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1223-6 (3 Oct. 1983).
A model of interacting random walks is proposed in which each new site visited has a weight factor p. For $1\leq p\leq\infty$, the model interpolates between purely random walks and self-avoiding walks. When $0<p<1$, the model describes attracting random walks (and also noninteracting random walks on a lattice with static traps), and shares some of the intriguing features of random walks on percolation fractals—e.g. dimension-independent exponents. (11 refs.)

117089 Fractal dimension of strange attractors from radius versus size of arbitrary clusters. Y.Termonia, Z.Alexandrowicz (Polymer Dept., Weizmann Inst. of Sci., Rehovot, Israel).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1265-8 (3 Oct. 1983).
A fractal dimension $D_{F'}$ of strange attractors is estimated as follows. Clusters of n nearest-neighbor points are sampled from a time series; $D_{F'}$ is found from $\bar{R}(D_{F'})\sim n$ where $\bar{R}$ is the average cluster's radius. The estimation of $D_{F'}$ is shown to be especially efficient for high dimensional systems. (17 refs.)

117090 Equivalence between random systems and continuous-time random walk: literal and associated waiting-time distributions. J.W.Haus (Fachbereich Phys., Univ. Essen-Gesamthochschule, Essen, Germany), K.W.Kehr.
Phys. Rev. B (USA), vol.28, no.6, p.3573-5 (15 Sept. 1983).
The authors derive the average waiting-time distribution of a particle that performs a random walk on a linear chain with random nearest-neighbour transition rates from a simple equilibrium consideration and the relation between the waiting-time distribution for the first and all other jumps. They estimate this waiting-time distribution by numerical simulations and find agreement with the analytical results. They further deduce an associated waiting-time distribution from recent results for the effective memory kernel of the disordered chain. The associated waiting-time distribution shows a power-law decay exponent $-^{5}/_{2}$ at long times which is not observed in the above-mentioned waiting-time distribution. They comment on the necessary distinction between the 'literal' and the 'associated' waiting-time distributions. (18 refs.)

117091 The application of Green's function to the investigation of the response of vehicle accelerating over random profile. W.Pekala (Centre of Res. & Dev. of Machines, Gliwice, Poland), J.Szopa.
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.3, p.295-310 (May-June 1983). [received: Sept. 1983]
Presents the application of Green's function to determine the probabilistic characteristics of solutions of stochastic linear equations with coefficients variable in time, random initial conditions and random excitations. The method is applied to calculate the variances of vertical vibrations of two-degree-of-freedom vehicle model (or suspension) accelerated over random profile. (27 refs.)

117092 Markovian fluctuation-dissipation theory of open radiophysical systems. R.L.Stratonovich (Moscow State Univ., Moscow, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.559-69 (July 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.779-90 (July 1982). [received: Sept. 1983]
An equality expressing the time reversibility of processes in Markovian open systems is derived. The reciprocity relations for processes involving relaxation to a nonequilibrium stationary state are analyzed. An equation is derived that describes the nonequilibrium stationary distribution for mixed open systems. (7 refs.)

117093 Behavior of the derivative of a random process at the times of crossing a given level. V.I.Khimenko (Inst. of Aircraft Instrumentation, Leningrad, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.575-81 (July 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.797-804 (July 1982). [received: Sept. 1983]
The distribution of the derivative of a continuous differentiable random process at the time when it crosses a certain given level is investigated. Simple analytical expressions are derived for the conditional probability density functions. The results are particularized for some of the most common non-Gaussian processes. All the distribution functions are represented as the ratios of the probabilities associated with the corresponding flows of events generated by the crossings, i.e. under conditions of the 'horizontal window' type. (8 refs.)

Generalized stochastic processes and continual observations in quantum mechanics .... See Entry 117027

Role of certain gradient vector fields in quantum mechanics .See Entry 117036

The simulation of quantum systems with random walks: a new algorithm for charged systems .... See Entry 117074

Cumulant renormalisation group and its application to the incipient infinite cluster in percolation .... See Entry 117097

Scaling of kinetically growing clusters .... See Entry 117110

Diffusion constant of a quantum particle moving in tight-binding media modulated by non-white noises .... See Entry 117124

Tagged particle fluctuations in uniform shear flow .... See Entry 117126

Fokker-Planck and Langevin descriptions of fluctuations in uniform shear flow .... See Entry 117127

Correction-to-scaling exponents and amplitudes for the correlation length of linear polymers in two dimensions .... See Entry 118019

Description of particle trajectories in classical Lennard-Jones liquids .... See Entry 118842

Space-time correlation properties of the magnetization process and eddy current losses: theory .... See Entry 119867

On the methods of spectral characterisation of random non-stationary processes with application to the study of Earth tremors. I .... See Entry 121150

On the methods of spectral characterisation of random nonstationary processes with application to Earth-tremor studies. II .... See Entry 121151

05.50 LATTICE THEORY AND STATISTICS; ISING PROBLEMS

(see also 75.10H Ising models)

117094 On supermodular lattices. V.R.Chandran, V.Lakshmanan (Ramanujan Inst. of Math., Univ. of Madras, Madras, India).
Indian J. Pure & Appl. Math., vol.14, no.9, p.1128-30 (Sept. 1983).
For the equational class of supermodular lattices the authors prove that the defining regular identity can be replaced by a balanced identity. (2 refs.)

117095 Phase diagrams of random Ising models: simple and systematic successive approximations. A.Benyoussef, N.Boccara (SPSRM, CENS, Gif sur Yvette, France).
J. Phys. (France), vol.44, no.10, p.1143-7 (Oct. 1983).
The authors present a sample and systematic method to calculate phase diagrams of random Ising models. It applies to a wide class of systems in which, however, randomness has to be described by discrete random variables. They calculated, at different orders of approximation, various quantities like critical temperatures and percolation thresholds in good agreement with exact known results. (8 refs.)

117096 Ground state of one-dimensional systems and fixed points of 2*n*-dimensional map. E.Allroth (Inst. fur Festkorperforschung, Kernforschungsanlage Julich, Julich, Germany).
J. Phys. A (GB), vol.16, no.14, p.L497-501 (1 Oct. 1983).
The ground-state problem for discrete one-dimensional systems with interactions between *n*-nearest neighbours is connected with 2*n*-dimensional maps. Fixed points of these maps correspond to periodic system configurations. For a general class of systems it is explicitly shown for the first time that fixed points with some elliptic character cannot represent ground states. (4 refs.)

117097 Cumulant renormalisation group and its application to the incipient infinite cluster in percolation. D.C.Hong, H.E.Stanley (Dept. of Phys., Boston Univ., Boston, MA, USA).
J. Phys. A (GB), vol.16, no.14, p.L525-9 (1 Oct. 1983).
The authors introduce the cumulant method into the context of position-space renormalisation group. The advantage of this method over previous procedures is that one need not systematically evaluate all 2^N states of each Kadanoff cell, where N is the number of elements (sites or bonds) in the cell. They illustrate this method by calculating, for bond percolation with an eight-bond cell, the critical exponents characterizing the following quantities: (i) the mean number of backbone bonds, (ii) the mean number of bonds in the minimum and maximum paths along the backbone, (iii) the mean number of singly connected ('red') bonds, and (iv) the mean number of bonds in all the self-avoiding walks connecting the two extreme points. They derive previously obtained results of the conductivity and resistivity. (17 refs.)

117098 The exact solution of a nonplanar Ising model. R.G.Bowers (Dept. of Appl. Math., Univ. of Liverpool, Liverpool, England).
J. Phys. A (GB), vol.16, no.14, p.L531-4 (1 Oct. 1983).
A generalisation of the star-triangle transformation is used to establish a correspondence between a nonplanar Ising lattice with two interaction constants and the standard triangular Ising model. The critical point of the nonplanar lattice is obtained exactly for various values of the ratio of the interaction constants. The singularity in the zero-field free energy of the nonplanar lattice is investigated. It is shown to be of the same form as that displayed by the corresponding standard Ising model. (10 refs.)

117099 Droplet structure in Ising and Potts models. A.Coniglio (Istituto di Fisica Teorica, Napoli, Italy), R.Figari.
J. Phys. A (GB), vol.16, no.14, p.L535-40 (1 Oct. 1983).
The structure of a recently introduced droplet in the q-state Potts model is analysed. The authors derive exact relations from which it follows that the incipient infinite droplet at the critical temperature is a self-similar fractal made of links and blobs, just as recently found in random percolation. The number of links N_{links} between two points separated by a distance of the order b is given by $N_{\mathrm{links}} \propto b^{1/\nu_{\mathrm{B}}(q)}$ where $\nu_{\mathrm{B}}(q)$ is the connectedness length exponent when $T=T_c(q)$ and p_{B} is used as an independent variable. This result and the available calculations of $\nu_{\mathrm{B}}(q)$ indicate that the number of links decreases as q increases. An analysis of the structure of the usual clusters made of nearest-neighbour sites in a given Potts site configuration is also made. In particular, it shows that for $d=2$ the incipient infinite cluster is made only of blobs and no links. (31 refs.)

117100 Exact fractals with adjustable fractal and fracton dimensionalities. D.Ben-Avraham, S.Havlin (Dept. of Phys., Bar-Ilan Univ., Ramat-Gan, Israel).
J. Phys. A (GB), vol.16, no.15, p.L559-63 (21 Oct. 1983).
A family of exact fractals is presented. By adjusting two external parameters, a wide range of fractal and fracton dimensionalities can be achieved. This includes the case of fracton dimensionality of 2, which is critical for diffusion. (11 refs.)

117101 Diffusion on fractal lattices and the fractal Einstein relation. J.A.Given, B.B.Mandelbrot (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
J. Phys. A (GB), vol.16, no.15, p.L565-9 (21 Oct. 1983).
Finitely ramified fractal lattices show anomalous diffusion with $\langle \mathrm{r}^2 \rangle \propto \mathrm{t}^{2\mathrm{H}}$. There is a hierarchy of transit times which are shown by Monte Carlo simulation to satisfy $\langle \tau_{\mathrm{n}} \rangle \propto \alpha^{\mathrm{n}}$ for large n, where $\alpha=\mathrm{b}^{1/\mathrm{H}}$ and b is the base of the lattice. The lattice resistivity scales with size as $\rho \propto \mathrm{R}^{\mathrm{n}}$ where R is characteristic of the lattice. Exact renormalisation group methods yield α and R analytically and verify the Einstein relation for fractals $\alpha=\mathrm{RN}$. (12 refs.)

117102 Spiral self-avoiding walks. V.Privman (Baker Lab., Cornell Univ., Ithaca, NY, USA).
J. Phys. A (GB), vol.16, no.15, p.L571-3 (21 Oct. 1983).
Self-avoiding walks with a 'spiral' constraint, on the square lattice, are enumerated up to 40 steps. Numerical evidence suggests that they belong to a new universality class. (19 refs.)

117103 Multicritical behaviour in the q-state Potts lattice-gas. T.Temesvari (Inst. for Theoretical Phys., Eotvos Univ., Budapest, Hungary), L.Herenyi.
J. Phys. A (GB), vol.16, no.15, p.L575-82 (21 Oct. 1983).
The phase diagram of the q-state Potts lattice-gas is determined exactly on a Cayley tree for $\mathrm{q}<2$. The authors use this result to make some conjectures concerning the lower-dimensional cases. It is argued that there should be a tetracritical point, different from the transition point where Ising droplets diverge, in the case of three-dimensional correlated site-bond percolation ($\mathrm{q}=1$). In two dimensions, the critical exponent γ_{p} of the mean cluster size at the Ising critical point is derived from the extended den Nijs conjectures: $\gamma_{\mathrm{p}}={}^{91}/_{48}=1.896$. (28 refs.)

117104 On square lattice directed percolation and resistance models. J.C.Wierman (Dept. of Math. Sci., Johns Hopkins Univ., Baltimore, MD, USA).
J. Phys. A (GB), vol.16, no.15, p.3545-51 (21 Oct. 1983).
Recent papers by Dhar et al. (1981) and Dhar (1982) showed that the standard directed percolation model, with blocked or one-way bonds, is dual to a percolation model with one-way or two-way bonds. This duality is exploited to improve lower bounds for the critical probability of the directed bond percolation model on the square lattice by considering k-order backflows. Two intuitive claims made in the papers mentioned above are verified by the author. Wedge angles of the directed percolation model and the dual model exist almost surely and sum to π. As the order of backflows $\mathrm{k} \to \infty$, the limit of the Dhar-Barma-Phani bounds is the correct critical probability. The proofs use techniques from the theories of subadditive processes and first passage percolation. (7 refs.)

117105 Directd percolation: series expansion for some three-dimensional lattices. K.De'Bell (Dept. of Phys., Dalhousie Univ., Halifax, Nova Scotia, Canada), J.W.Essam.
J. Phys. A (GB), vol.16, no.15, p.3553-60 (21 Oct. 1983).
Low density series expansions have been obtained for the directed cubic lattice bond problem and the directed cubic and body centred cubic lattice site problems. Estimates of the critical probabilities and critical exponents γ, γ_0, $\nu\|$, $\nu_\perp$ for these problems are obtained. The exponent values are found to be consistent with the universality of directed percolation and Reggeon field theory and the hyperscaling relation $\beta=(\mathrm{D}\nu_\perp+\nu\|\text{-}\gamma)/2$. (12 refs.)

117106 Renormalisation group for percolation using correlation parameters. G.F.Tuthill (Dept. of Phys., Montana State Univ., Bozeman, MT, USA), W.Klein.
J. Phys. A (GB), vol.16, no.15, p.3561-70 (21 Oct. 1983).
The authors have applied position-space RG methods to the problem of percolation of correlated sites on the square and simple cubic lattices. The approach uses a cell-to-site transformation and superposition approximation to renormalise the site probabilities and a set of correlation parameters. In two dimensions they find two non-trivial fixed points, for random percolation and Ising-correlated percolation respectively. In three dimensions only a single non-trivial physically accessible fixed point is found, controlling the percolation of random sites. In contrast to the two-dimensional case a fixed point for positive values of correlation is found to have complex eigenvalues, and does not correspond to a physical percolation point. The finding of a single universality class for correlated percolation in three dimensions is in agreement with the known behaviour of Ising-correlated percolation. (19 refs.)

117107 2D pure and dilute quantum transverse Ising model. G.Kamieniarz (Inst. of Phys., A Mickiewicz Univ., Poznan, Poland).
J. Phys. C (GB), vol.16, no.28, p.L1021-24 (10 Oct. 1983).
The quantum critical behaviour of the transverse Ising model on a planar lattice at zero temperature is shown, within approximate block renormalisation-group transformations, to be unaffected by the bond dilution. The critical exponents and the critical fields are calculated for both pure and dilute systems. (25 refs.)

117108 Critical behavior of a three-dimensional dimer model. S.M.Bhattacharjee, J.F.Nagle (Dept. of Phys., Carnegie-Mellon Univ., Pittsburgh, PA, USA), D.A.Huse, M.E.Fisher.
J. Stat. Phys. (USA), vol.32, no.2, p.361-74 (Aug. 1983).
The phase transition behavior of a dimer model on a three-dimensional lattice is studied. This model is of biological interest because of its relevance to the lipid bilayer main phase transition. The model has the same kind of inactive low-temperature behavior as the exactly solvable Kasteleyn dimer model on a two-dimensional honeycomb lattice. Because of low-temperature inactivity, determination of the lowest-lying excited states allows one to locate the critical temperature. The second-lowest-lying excited states are studied and exact asymptotic results are obtained in the limit of large lattices. These results together with a finite-size scaling ansatz suggest a logarithmic divergence of the specific heat above T_c for the three-dimensional model. Use of the same ansatz recovers the exact divergence ($\alpha=1/2$) for the two-dimensional model. (15 refs.)

117109 Phase diagram of a spin-1 quantum Ising model with dipole and quadrupole interactions. C.Buzano (Dipartimento di Fisica del Politecnico, Torino, Italy), M.Rasetti, P.T.Valabrega.
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.257-74 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
A quantum Ising-like spin-1 system with both dipole and quadrupole interactions is analyzed. Such model is a generalized quantum version of the Blume-Emery-Griffiths model (1971) in an external anisotropic field. Models of this type are interesting candidates to describe phase transitions in liquid crystals. The phase diagram as well as the thermodynamic potentials of the model are constructed by a recently formulated improved version of mean field theory. The latter, which has the usual mean field theory as its zero-th order approximation, takes into account fluctuations up to the fourth-order. The phase diagram is found to exhibit phase transition manifolds of both the first and the second order, as well as multicritical lines. Four phases can be recognised: one ferromagnetic and three paramagnetic. The phases are identified by the requirements of minimum free energy constrained by the condition of self consistency of the order parameters ρ and q. (10 refs.)

117110 Scaling of kinetically growing clusters. M.Kolb, R.Botet, R.Jullien (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1123-6 (26 Sept. 1983).
A model describing the process of cluster growth by aggregation of clusters is introduced and investigated with the Monte Carlo method. It is found that the clusters are scale invariant. The fractal dimension of this new class of kinetic critical behavior is $D=\nu^{-1}=1.38\pm0.06$ in $d=2$ dimensions as determined by the radii of gyration and the density correlations of the aggregates. The process is compared with other types of kinetic and equilibrium critical phenomena. (23 refs.)

117111 Competing criticality of short- and infinite-range interactions on the Cayley tree. M.Kardar, M.Kaufman (Dept. of Phys., MIT, Cambridge, MA, USA).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1210-13 (26 Sept. 1983).
The Ising model, with equivalent-neighbor and nearest-neighbor interactions of Cayley-tree connectivity, is solved exactly. Breaking translational symmetry by turning on the Cayley interactions is analogous to lowering spatial dimensionality in Bravais lattices. A range of classical criticality, a point of logarithmic corrections, a range of continuously varying power-law singularities, and a point of exponential singularity are successively encountered. (21 refs.)

117112 Monte Carlo study of scale-covariant field theories. A.T.Ogielski (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. D (USA), vol.28, no.6, p.1461-72 (15 Sept. 1983).
The author investigates the continuum limit of Klauder's field-theory models defined on a hypercubic lattice in four dimensions by mapping this problem onto a statistical-mechanical problem of an analog spin system, with partition function $Z=\int_{-\infty}^{\infty}\Pi_{\mathrm{x}}(dS_{\mathrm{x}}/|S|^{\mathrm{B}})\exp(-A\Sigma_{\mathrm{x}}S_{\mathrm{x}}{}^2-u_0\Sigma_{\mathrm{x}}S_{\mathrm{x}}{}^4+K\times\Sigma_{\mathrm{x},\mu}S_{\mathrm{x}}S_{\mathrm{x}+\mu}\quad)$ and A a given function of u_0 and B determined from an appropriate normalization of transitions in the regime $0\leq B<1$, and in particular the behavior of the renormalized coupling constant g_{R}. For $B>0$ the authors find a line of first-order transitions for small u_0, while for larger values of u_0 there is a line of second-order transitions very similar to the Ising-type transitions of the usual ($B=0$) theory, and characterized by vanishing of the renormalized coupling g_{R}. Only in the latter case can the continuum field theory be defined, and it appears to be trivial free field theory for any choice of the parameter B. (17 refs.)

117113 Elementary excitations of the quantum sine-Gordon model in the massless regime $\beta^2>8\pi$: derivation from the *XXZ* model. F.D.M.Haldane (Dept. of Phys., Univ. of Southern California, Los Angeles, CA, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2505-8 (1 Sept. 1983).
From the identification of the easy-plane *XXZ* spin chain as a $\beta^2>8\pi$ quantum sine-Gordon system, the nonlinear elementary excitations of the latter are identified as massless 'twists' carrying the topological charge $\pm\beta^2/8\pi$, and (depending on β^2) twist-antitwist bound states. (16 refs.)

117114 Field-theoretic approach to biconnectedness in percolating systems. A.B.Harris (Schlumberger-Doll Res., Ridgefield, CT, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2614-29 (1 Sept. 1983).
A general method is given whereby m-connectedness correlation functions can be studied in the percolation problem. The method for $m=1$ involves calculating the kth power of the correlation function $\langle\sigma(x)\sigma(x')\rangle$ for a randomly dilute Ising model at nonzero temperature and subsequently averaging over configurations. The final step is to take the limit $k \to 0$. This method is tested by reproducing the standard results for the percolation problem from an extension of the calculation of Stephen and Crest. For $m>1$ an additional 'color' index is introduced and a Hamiltonian is constructed in which different colors repel one another, thereby giving an exact prescription for m-connectedness. Order parameters for m-connectedness are identified. The $m=2$ order parameter couples through a trilinear term to the $m=1$ order parameter. The main result is that $\beta^{(\mathrm{m})}$ the exponent for m-connectedness is given by $\beta^{(\mathrm{m})}=m\beta+\nu\psi^{(\mathrm{m})}$, where β and ν are the usual exponents for percolation and $\psi^{(\mathrm{m})}$ is a new crossover exponent which, to lowest order in $\varepsilon=6-d$, is given by $\psi^{(\mathrm{m})}=m(m-1)\varepsilon^2/49$. This result implies that the fractal dimensionality of the biconnected part of the critically percolating cluster is given in terms of the percolation critical exponents as $\gamma/\nu-\psi^{(2)}$. If 'nodes' are defined as triconnected points, then $\beta^{(3)}$ is the critical exponent associated with their density in the infinite cluster. The author also discusses evidence that the 'node-link' model of Skal-Shklovskii-de Gennes breaks down for d less than some critical value $\hat{d}$. Numerically he adduces evidence that $\hat{d}$ may be larger than 3. (81 refs.)

117115 Finite-size-scaling study of a two-dimensional lattice-gas model with a tricritical point. P.A.Rikvold, W.Kinzel, J.D.Gunton, K.Kaski (Inst. fur Festkorperforschung, KFA Julich GmbH, Julich, Germany).
Phys. Rev. B (USA), vol.28, no.5, p.2686-92 (1 Sept. 1983).
The authors present a finite-size-scaling study of a two-dimensional square-lattice-gas model with nearest-neighbor repulsion and next-nearest-neighbor attraction. This system may be used as a simplified model of adsorbates on transition-metal (100) surfaces. An accurate determination of the tricritical temperature is obtained by the utilization of the degeneracy of the three largest eigenvalues of the transfer matrix at a critical point. They obtain the phase diagram and critical and tricritical exponents, all quite consistent with previously known results. They also find that a recent conjecture relating the

critical exponent η to the correlation-length amplitude seems to work well even at the tricritical point. (25 refs.)

117116 Renormaization-group study of the Hamiltonian version of the Potts model. II. Self-dual renormalization-group treatment. F.Igloi, M.Solyom (Central Res. Inst. for Phys., Budapest, Hungary).
Phys. Rev. B (USA), vol.28, no.5, p.2785-91 (1 Sept. 1983).
The one-dimensional Hamiltonian version of the two-dimensional Potts model is studied by the application of a self-dual renormalization-group transformation. Blocks containing up to 11 sites are considered and mapped into new, equivalent Potts spins by keeping the lowest-lying levels only. The higher-lying states are also taken into account in a perturbational wave for smaller cells. Unfortunately, this renormalization-group treatment cannot reproduce the first-order transition for large values of the number of states, and the critical exponents for the three-and four-state Potts model do not seem to converge to the conjectured results as larger and larger blocks are taken. (14 refs.)

117117 Solutions to the Schrodinger equation on some fractal lattices. E.Domany (Dept. of Electronics, Weizmann Inst. of Sci., Rehovot, Israel), S.Alexander, D.Bensimon, L.P.Kadanoff.
Phys. Rev. B (USA), vol.28, no.6, p.3110-23 (15 Sept. 1983).
The Schrodinger equation is solved on a variety of fractal lattices using a recursive technique. In this method, the energy levels and wave functions on a lattice with N_n sites are calculated in terms of the corresponding quantities on a smaller lattice with N_{n-1} sites, via a kind of decimation process. As $n \to \infty$ the resulting energy levels are discrete, very closely spaced, and highly degenerate. Smoothed densities of states have a wide variety of singularities. (9 refs.)

117118 Long-range correlations in Bethe lattices. F.Yndurain, R.Barrio (Dept. de Fisica Fundamental, Univ. Autonoma de Madrid, Madrid, Spain), R.J.Elliott, M.F.Thorpe.
Phys. Rev. B (USA), vol.28, no.6, p.3576-8 (15 Sept. 1983).
The authors show that the long-range correlations in Bethe lattices contain pathological features that cause great difficulties when calculating physical properties that depend on them. (11 refs.)

Formation of fractal clusters and networks by irreversible diffusion-limited aggregation .... See Entry 117087

Novel superuniversal behavior of a random-walk model .... See Entry 117088

Continuum fluids with a discontinuity in the pressure .... See Entry 117132

Pinning transition of the discrete sine-Gordon equation .... See Entry 117140

Mechanism of symmetry breaking in the spherical limit: phase coherence in finite-size systems .... See Entry 117141

Second order phase transition in a four-dimensional Z_2 gauge theory .... See Entry 117352

Correction-to-scaling exponents and amplitudes for the correlation length of linear polymers in two dimensions .... See Entry 118019

The use of lattice theory in the calculation of excess properties of fluid mixtures. VI. Prediction of Gibbs' free energies and enthalpies of mixing of binary systems using model by Tompa .... See Entry 119201

A Monte Carlo study of the three-states antiferromagnetic Potts model in two dimensions .... See Entry 119799

05.60 TRANSPORT PROCESSES: THEORY

117119 The differential equations for the processes of statistical kinematics in solids. A.Sobaszek (Inst. of Phys., Warsaw Tech. Univ., Warsaw, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.3, p.295-307 (Sept. 1983).
The differential equations for the processes of statistical kinematics are obtained for the case of discrete free paths and time statistical distributions. The results may be especially useful in the following cases: (1) when the distribution of concentration contains high-order harmonics (i.e. for short diffusion times or for thin layers), (2) when atoms migrate in a field of driving forces, (3) when central moments of statistical distributions of lengths of jumps and of their frequencies differ from zero. The possibility of generating waves of concentration is pointed out. Applications to neutron transport theory are also possible. (8 refs.)

117120 Derivative estimates for eigenfunctions with accessible boundaries and application to diffusions. M.V.Day (Dept. of Math., Virginia Polytech. Inst., Blacksburg, VA, USA).
Appl. Anal. (GB), vol.16, no.4, p.329-44 (1983).
The author considers an eigenvalue problem on a bounded interval and establishes some uniform bounds on the first derivatives of the L^2-normalized eigenfunctions in terms of the eigenvalues. Such bounds are established for singular boundaries of regular type and most cases of exit type, according to Feller's boundary classification. Implications of such bounds for diffusion semigroups are discussed and an application is made to a property of conditional diffusions. (8 refs.)

117121 Thermogenesis: inverse filters. E.Cesari, J.Vinals (Dept. de Termologia, Facultat de Fisica, Barcelona, Spain), J.Ortin, V.Torra.
An. Fis. Ser. B (Spain), vol.79, no.2, p.128-33 (May-Aug. 1983). [received: Oct. 1983]
The obtaining of the thermogenesis through inverse filtration ideally requires the correction of the whole transfer function (TF) of the system; that is, the elimination of the whole series of poles and zeros. Present methods of identifying the first poles and zeros of the calorimeter are briefly discussed, together with the limitations which arise as a consequence of experimental noise. Moreover, the comparison between the frequency representation of the filter and the experimental spectrum of the device obtained through harmonic analysis allows an estimate of the deconvolutive performance of the device obtained through harmonic analysis allows an estimate of the technique and an interpretation of the delays and overcorrections appearing in the thermogene is given by the filter. (6 refs.)

117122 Numerical-analytical algorithm for solving transfer equations for a plane layer. V.I.Bilenko.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.65-9 (1983). In Ukrainian.
A simple numerical-analytical algorithm is given to solve the boundary-value problem for the linear integro-differential equation of radiation transfer in a plane layer. Conditions of the approximate operator equation, solvability algorithm error estimations and computation results of the numerical example are available. (12 refs.)

117123 Time-reversal noninvariance of generalized quantum mechanical Boltzmann kinetic equation derived by Keldysh. Z.A.Nikolic-Mojse (Pedagogical-Tech. Faculty, Zrenjanin, Yugoslavia).
Fizika (Yugoslavia), vol.15, no.3, p.255-61 (July-Sept. 1983).
Considering the time-reversed system and using diagram techniques for anticausal Green function it was shown that the origin of time-reversal noninvariance (of generalized quantum-mechanical Boltzmann kinetic equation) derived by Keldysh (1965) stems from the selection of the boundary condition that the perturbed system was in the thermodynamical equilibrium at the moment $t = -\infty$. (5 refs.)

117124 Diffusion constant of a quantum particle moving in tight-binding media modulated by non-white noises. Y.Inaba (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3144-53 (Sept. 1983).
Diffusion of a particle or an excitation in randomly fluctuating media is studied theoretically. The model is a tight-binding Hamiltonian whose diagonal or off-diagonal elements are modulated by mutually-independent random noises. The non-white modulation models are investigated precisely. The diffusion constant (D) depends on the noise-parameters such as the amplitude (Δ) and the correlation time (γ^{-1}) and also depends on the static band width (W). Explicit calculation of D has been performed by using the dynamical coherent potential approximation and by computer experiments. In the case that diagonal elements are modulated by discrete-jump noises, D as a function of γ has a minimum in the vicinity of $\hbar\gamma = \Delta \gg W$. On the contrary, $D(\gamma)$ is a monotonically-increasing function of γ if $\Delta \ll W$. In the off-diagonal fluctuation case, the diffusion constant exhibits a feature qualitatively different from the diagonal fluctuation model. (13 refs.)

117125 On the spherical harmonics and discrete ordinates methods for azimuth-dependent intensity calculations. A.H.Karp (IBM Sci. Center, Palo Alto, CA, USA), S.Petrack.
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.4, p.351-6 (Oct. 1983).
It is known that the azimuth-averaged component of the intensity computed from the spherical harmonics method for solving the equation of radiative transfer is 'exact' at the Gauss quadrature points. The authors show that a similar relation holds for higher terms in the Fourier expansion of the intensity but that the results are 'exact' at the zeros of the associated Legendre polynomials. The relationship between the discrete ordinates and spherical harmonics methods follows from this discussion. A discrete ordinates quadrature scheme, based on the zeros of the associated Legendre polynomials, is shown to maintain the correspondence of the methods for these problems, as well as providing a better set of points than other methods in use. (15 refs.)

117126 Tagged particle fluctuations in uniform shear flow. M.C.Marchetti, J.W.Dufty (Inst. for Phys. Sci. & Technol., Univ. of Maryland, College Park, MD, USA).
J. Stat. Phys. (USA), vol.32, no.2, p.255-77 (Aug. 1983).
The nonlinear Boltzmann and Boltzmann-Lorentz equations are used to describe the dynamics of a tagged particle in a nonequilibrium gas. For the special case of Maxwell molecules with uniform shear flow, an exact set of equations for the average position and velocity, and their fluctuations, is obtained. The results apply for arbitrary magnitude of the shear rate and include the effects of viscous heating. A generalization of Onsager's assumption of the regression of fluctuations is found to apply for the relationship between the equations for the average dynamics and those for the time correlation functions. The connection between fluctuations and dissipation is described by the equations for the equal-time correlation function. The source term in these equations indicates that the 'noise' in this nonequilibrium state is qualitatively different from that in equilibrium, or even local equilibrium. These equations are solved to determine the velocity autocorrelation function as a function of the shear rate. (17 refs.)

117127 Fokker-Planck and Langevin descriptions of fluctuations in uniform shear flow. R.F.Rodriguez (Thermophys. Div., NBS, Washington, DC, USA), E.Salinas-Rodriguez, J.W.Dufty.
J. Stat. Phys. (USA), vol.32, no.2, p.279-98 (Aug. 1983).
The Boltzmann description for tagged particle fluctuations in a nonequilibrium gas (Marchetti and Dufty, 1983) is further analyzed in the limit of small mass ratio between the gas and the tagged particles. For a large class of nonequilibrium states the Boltzmann-Lorentz collision operator for the tagged particle distribution is expanded to leading order in the mass ratio, resulting in a Fokker-Planck operator. The drift vector and diffusion tensor are calculated exactly for Maxwell molecules. The Fokker-Planck operator depends on the nonequilibrium state only through the hydrodynamic variables for the fluid. The diffusion tensor is a measure of the 'noise' amplitude and is not simply determined from the nonequilibrium temperature; instead, it depends on the fluid stress tensor components as well. For the special case of uniform shear flow, the Fokker-Planck equation is of the linear type and may be solved exactly. The associated set of Langevin equations is also identified and used to describe spatial diffusion in the Lagrangian coordinates of the fluid. The effect of viscous heating on diffusion is discussed and the dependence of the diffusion coefficient on the shear rate is calculated. (11 refs.)

117128 Material transport in hyperfiltration. H.Vink (Inst. of Phys. Chem., Univ. of Uppsala, Uppsala, Sweden).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.10, p.2359-65 (Oct. 1983).
Transport equations for hyperfiltration, based on the frictional formalism of non-equilibrium thermodynamics, are derived for a gel-type membrane. Taking the concentration distribution in the membrane into account and allowing for possible non-equilibrium partition effects at the membrane boundaries, the flow equations are integrated and equations for solute rejection in dilute solutions are derived. The main parameters determining solute rejection are the solute partition coefficient on the high-pressure side of the membrane and a frictional factor, involving the solute and solvent friction coefficients. Partition effects on the low-pressure side are unimportant for processes at high flow rates. (17 refs.)

117129 Theory of the passage of particles and waves through randomly inhomogeneous media. I.M.Lifshitz (S.I. Vavilov Inst. of Phys. Problems., Acad. of Sci., Moscow, USSR), S.A.Gredeskul, L.A.Pastur.
Sov. Phys.-JETP (USA), vol.56, no.6, p.1370-8 (Dec. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.6, p.2362-76 (Dec. 1982). [received: Oct. 1983]
A study is made of the statistical properties of the transparency of a disordered layer. The asymptotic behavior of the transparency of a thick layer is investigated in quasi-one-dimensional and three-dimensional cases: in particular, a formula is obtained for the relationship between the self-averaging decrement of the transparency and the asymptotic value of the transparency probability density of separate filaments forming a quasi-one-dimensional layer. Expansions of the decrement are obtained in powers of the density of scatterers for different positions of the incident particle energy relative to the spectrum of an infinite disordered system. (12 refs.)

Derivation of the Boltzmann equation for a Fermi gas ....See Entry 117075

Nonlinear quantum dynamical semigroups for many-body open systems ....See Entry 117076

Shape dependence of correlation times in chaos-induced diffusion ....See Entry 117084

Resistance of random walks ....See Entry 117086

Exact fractals with adjustable fractal and fracton dimensionalities ....See Entry 117100

Diffusion on fractal lattices and the fractal Einstein relation ....See Entry 117101

Angular flux of 662 keV gamma-ray transport in water ....See Entry 117701

Experimental determination of nocturnal radiation ....See Entry 118357

Hydrodynamic and mass transfer characteristics of polypropylene multifilament wire gauze packings ....See Entry 118546

Compatibility criteria for generalized Boltzmann equations ...See Entry 118642

Mass transfer studies in porous electrodes: application of the limiting current technique ....See Entry 118668

Disordered-resistor network approach to the effective conductivity in inhomogeneous continua with substitutional disorder ....See Entry 119533

05.70 THERMODYNAMICS

(see also 44.60 Thermodynamic processes, 64. Equations of state, phase equilibria and phase transitions, 65. Thermal properties of condensed matter; for chemical thermodynamics, see 82.60)

117130 Optimal control of thermodynamic processes. II. L.I.Rozonoer, A.M.Tsirlin.
Autom. & Remote Control (USA), vol.44, no.2, pt.2, p.209-20 (Feb. 1983). Translation of: *Avtom. & Telemekh. (USSR)*, vol.44, no.2, p.88-101 (Feb. 1983). [received: Oct. 1983]
For pt.I see Avtomatika i Telemekhanika, vol.44, no.1, p.70 (1983) or Automation and Remote Control, vol.44, no.1, p.55 (1983). Maximization of the work in a nonequilibrium system in fixed time is considered. The well-known thermodynamic results concerning the maximum work constitute a limiting case when the process time tends to infinity. (3 refs.)

117131 Kinetic mean field theories: Results of energy constraint in maximizing entropy. G.Stell (Depts. of Mech. Engng. & Chem., State Univ. of New York, Stony Brook, NY, USA), J.Karkheck, H.van Beijeren.
J. Chem. Phys. (USA), vol.79, no.6, p.3166-7 (15 Sept. 1983).
In a previous article (ibid., vol.75, p.1475, 1981), two of the authors defined and discussed a family of kinetic mean-field theories (KMFT) of transport relevant to simple dense fluids modeled by a system of particles interacting via a pair potential $\phi(r_{12})$ with hard-sphere core $\phi^{HS}(r_{12})$ and an arbitrary soft tail $\phi_t(r_{12})$. They quantitatively assessed a pair of these theories—a kinetic variational theory (KVT) derived from maximizing the entropy with certain simple constraints (a key constraint being core impenetrability), and an immediate extension, the kinetic reference theory (KRT) in which the velocity-correlated collisional effects ignored in the KVT are approximated by those of a hard-sphere reference system at the same local number density $n(r,t)$. The authors have continued their study in this area. (8 refs.)

117132 Continuum fluids with a discontinuity in the pressure. G.W.Milton, M.E.Fisher (Baker Lab., Cornell Univ., Ithaca, NY, USA).
J. Stat. Phys. (USA), vol.32, no.2, p.413-38 (Aug. 1983).
A class of one-dimensional continuum fluid models is defined in which classical particles interact through translationally-invariant strongly-tempered many-body potentials meeting conditions sufficient to ensure a proper thermodynamic limit. However, an exact analysis demonstrates that for certain ranges of parameter values the pressure versus density isotherms are discontinuous. The basic models also entail discontinuous temperature versus configurational entropy isobars but extended models are described which exhibit either type of anomaly alone and various unobserved but thermodynamically allowed, anomalous types of first-order transitions. (18 refs.)

117133 Viscous effects in the frictional formalism of non-equilibrium thermodynamics. H.Vink (Inst. of Phys. Chem., Univ. of Uppsala, Uppsala, Sweden).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.10, p.2355-8 (Oct. 1983).
A hydrodynamic interpretation of the frictional formalism of non-equilibrium thermodynamics indicates that viscous effects are inherent in the formalism, provided the component velocities are properly averaged. Under these circumstances transport processes in porous media can be treated without reference to the structure of the medium. The treatment can be applied to open pore structures as well as to dense gels, and takes into account both diffusive transport and viscous flow phenomena. (10 refs.)

117134 Generalized local balance concepts in non-equilibrium thermodynamic field theory. R.T.Balmer (Dept. of Mech. Engng., Univ. of Wisconsin, Milwaukee, WI, USA).
J. Non-Equilibrium Thermodyn. (Germany), vol.8, no.1, p.19-28 (1983).
A reorganized development of the local rate balance equation is shown to produce generalized expressions for the local fluxes and production rates of intensive thermodynamic properties. These expressions are composed of terms associated with each variable upon which the intensive property is assumed to depend. When these results are applied to entropy it is shown that the specific entropy production rate is composed of more than just the product of generalized forces and generalized fluxes. Terms originating from the generation (i.e. production or destruction) of the independent variables in the specific entropy function also appear in its production rate. (8 refs.)

117135 Balance equation of open multicomponent systems. I. Mass and momentum balance. W.H.Muller, W.Muschik (Tech. Univ. Berlin, Berlin, Germany).
J. Non-Equilibrium Thermodyn. (Germany), vol.8, no.1, p.29-45 (1983). In German.
Starting from the global balance equations of mass, momentum, energy and entropy for discrete open systems relations between quantities of the mixture and those of the components of the mixture are derived. All dynamical non-equilibrium quantities such as stress tensor, temperature, chemical potential and entropy are defined as contact quantities between discrete systems. The connexion between this approach and the usual local balance equations is discussed. (7 refs.)

117136 Balance equation of open multicomponent systems. II. Energy and entropy balance. W.Muschik, W.H.Muller (Tech. Univ. Berlin, Berlin, Germany).
J. Non-Equilibrium Thermodyn. (Germany), vol.8, no.1, p.47-66 (1983).
For pt.I see ibid., vol.8, p.29 (1983). Starting from the global balance equations of mass, momentum, energy and entropy for discrete open systems relations between quantities of the mixture and those of the components of the mixture are derived. All dynamical non-equilibrium quantities such as stress tensor, temperature, chemical potential and entropy are defined as contact quantities between discrete systems. The connexion between this approach and the usual local balance equations is discussed. (21 refs.)

117137 Quantum sine-Gordon thermodynamics. X.Zotos (Phys. Dept., Univ. of Southern California, Los Angeles, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.477-80 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Using the Bethe ansatz method the author analyzes the thermodynamics of the quantum sine-Gordon model. He presents a finite set of coupled nonlinear integral equations for the thermodynamic equilibrium densities of the various excitations, which he solves numerically. He calculates the specific heat and compares his results with recent experiments of CsNiF$_3$ and TMMC. The good accord obtained indicates the importance of quantum effects. (9 refs.)

117138 Geometrical approach to moving-interface dynamics. R.C.Brower (Lyman Lab. of Phys., Harvard Univ., Cambridge, MA, USA), D.A.Kessler, J.Koplik, H.Levine.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1111-14 (26 Sept. 1983).
A general class of models is introduced which relate the motion of a phase boundary to properties of the local interfacial geometry. These systems can undergo successive destabilizations as they grow, possibly giving rise to nonequilibrium spatial patterns. This normalism has applications to a wide variety of physical problems, especially including dendritic solidification. (16 refs.)

117139 Thermodynamic length and dissipated availability. P.Salamon (Dept. of Math. Sci., San Diego State Univ., San Diego, CA, USA), R.S.Berry.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1127-30 (26 Sept. 1983).
New expressions for the availability dissipated in a finite-time endoreversible process are found by use of Weinhold's (1976) metric on equilibrium states of a thermodynamic system. In particular, the dissipated availability is given by the square of the length of the corresponding curve, times a mean relaxation time, divided by the total time of the process. The results extend to local thermodynamic equilibrium if instead of length one uses distance (length of the shortest curve) between initial and final states. (13 refs.)

117140 Pinning transition of the discrete sine-Gordon equation. S.N.Coppersmith, D.S.Fischer (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2566-81 (1 Sept. 1983).
The ground state of the discrete sine-Gordon equation, used to model a one-dimensional solid in a periodic potential is examined in the incommensurate region. The behaviour of the system near the transition from an unpinned to a pinned phase (first discussed by Aubry) is investigated. A disorder parameter and a correlation length are defined and shown numerically to obey scaling relations on both sides of the transition. The system studied is equivalent to the 'standard map' of dynamical systems theory, and this relationship is discussed. In particular, the authors' results extend the scaling behaviour found by Shenker and Kadanoff into the 'chaotic' regime. (25 refs.)

117141 Mechanism of symmetry breaking in the spherical limit: phase coherence in finite-size systems. F.de Pasquale, Z.Racz, P.Tartaglia (Istutito di Fisica, Univ. degli Studi di Roma, Roma, Italy).
Phys. Rev. B (USA), vol.28, no.5, p.2582-7 (1 Sept. 1983).
The appearance of symmetry breaking in the thermodynamic limit is studied from a dynamical point of view. The authors solved the time-dependent Landau-Ginzburg model in the spherical limit and show that the finite-size develops a phase-coherence phenomenon analogous to that appearing in lasers. Below the critical point of the infinite system the orientational diffusion of the magnetization becomes the slowest mode and its time scale is well separated from all the other relaxational mechanisms. As expected, this phase diffusion freezes in completely in the thermodynamic limit. (15 refs.)

Phase diagrams of random Ising models: simple and systematic successive approximations ....See Entry 117095

Multicritical behaviour in the q-state Potts lattice-gas ....See Entry 117103

Phase diagram of a spin-1 quantum Ising model with dipole and quadrupole interactions ....See Entry 117109

Competing criticality of short- and infinite-range interactions on the Cayley tree ....See Entry 117111

Finite-size-scaling study of a two-dimensional lattice-gas model with a tricritical point ....See Entry 117115

Renormaization-group study of the Hamiltonian version of the Potts model. II. Self-dual renormalization-group treatment ....See Entry 117116

06.00 MEASUREMENT SCIENCE, GENERAL LABORATORY TECHNIQUES, AND INSTRUMENTATION SYSTEMS

06.20 METROLOGY

06.20D Measurement and error theory

117142 Statistical errors for non-linear system measurements involving square-law operations. J.S.Bendat (J.S. Bendat Co., Los Angeles, CA, USA).
J. Sound & Vib. (GB), vol.90, no.2, p.275-82 (22 Sept. 1983).
Develops normalized random error formulas for special bispectra estimates and associated frequency response function estimates in finite memory square-law systems. Error formulas are also derived for output spectrum estimates from these non-linear systems and for associated non-linear coherence functions. These formulas are useful to evaluate such measured non-linear results as well as to design experimental programs. (3 refs.)

117143 Directions of building the structure of metrology. R.A.Krajewski (Politech. Gdanskiej, Gdansk, Poland).
Pomiary Autom. Kontrola (Poland), vol.29, no.4, p.115-16 (April 1983). In Polish. [received: Sept. 1983]
Laying emphasis on the significance of the need of a precise description of measuring procedures, the author presents a method for suitably arranging the empirical knowledge of measurements, based on a system theory method and using decomposition methods. (19 refs.)

117144 Signal optimization for space-time-variant measuring problems. M.Peschel, M.Zecha, A.Moltmann (Akad. der Wissenschaften, Berlin, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.125-34 vol.3
Describes an impulse method for the evaluation of system functions in space-time-variant measuring processes. On the base of the properties of this computed system functions a new method is developed for processing of impulse responses or parts of them. This processing principle, which is due to the homomorphic filtering theory, permits an adaptive procedure to optimize the output of measuring channels under real conditions. (4 refs.)

117145 Basis for application of the Campbell-method for stochastic signals. M.Kreiner, H.Weiss (Inst. of Electrical Measurement Technol., Tech. Univ. of Graz, Graz, Austria).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.207-16 vol.3
Describes the investigations to obtain knowledge about the applicability of the Campbell-method for stochastic signal measurements. Experiments are described, to prove the linearity of several relations stated by Ronald M. Lichtenstein (1959) for nuclear radiation measurements. It was found out that the linear relationship does not exist in all predicted cases. It is shown that the basis for application of the Campbell-method are special random processes like Poisson or Gaussian Process. (5 refs.)

117146 Effective utilization of analytical instrument on measurement system—transitional measurement of amplitude probability density distribution for random fluctuation by pulse height analyzer and its application. K.Kariya (Dept. of Electricity, Ritsumeikan Univ., Kyoto, Japan).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.743-50
The system construction for transitional measurement of amplitude probability density distribution (TM of APDD) and its application to the electric contacts measurement and the meteorological measurement are dealt with. These studies were carried out as the effective utilization of analytical instruments in the problems of systematization measurement. The system construction of TM of APDD using pulse height analyzer (PHA) is shown as a system which contributes to the problem of the prediction, the estimation and the filtering on the time series analysis. (9 refs.)

Determination of the KTTs-5.048 colorimeter error when measuring the picture tube screen chromaticities .... See Entry 117216

The accuracy of heat conductance measurements with cylindrical samples .... See Entry 118361

Standard function and analysis errors in spectrochemical analysis. II. Weighted regression with variable precision of measurement .... See Entry 120707

A dynamical estimation method of environmental noise system based on the quantized level measurement contaminated by the background noise .... See Entry 120797

06.20H Measurement standards and calibration

Interlaboratory study on linewidth measurements for antireflective chromium photomasks .... See Entry 117153

Testing of strain-gauge pressure transducers up to 3.5 MPa at cryogenic temperatures and in magnetic fields up to 6 T .... See Entry 117196

The development of the reference standard cells and its prediction method .... See Entry 117200

A national standardization program for spectrophotometry ... See Entry 117212

Scanning radiometer for calibrating thermal imager test targets .... See Entry 117215

Spectral responsivity standard for infrared detectors .... See Entry 117233

In situ calibration of nuclear plant platinum resistance thermometers using Johnson noise methods .... See Entry 117644

Radon measurement intercomparisons .... See Entry 117726

The intercalibration of a radon daughter detection system with a radon detection system .... See Entry 117727

Radiochemical isolation and radioactivity calibration of radium-228 by liquid-scintillation counting and gamma-ray spectrometry .... See Entry 118001

Nanosecond pulse generators for testing performance of high-speed photon counting system .... See Entry 118106

Microphone sensitivity calibration under high intensity sound .... See Entry 118341

An absolute intensity standard for small-angle X-ray scattering measured with position-sensitive detectors .... See Entry 118809

New strain standards for glassware stress photoelastic evaluation .... See Entry 120542

Method for the calculation of radon response characteristics of integrating detectors .... See Entry 121020

06.30 MEASUREMENT OF BASIC VARIABLES

Sensors for mechanical properties .... See Entry 117162

A membrane-type zero pressure-difference indicator .... See Entry 117164

Properties of a series crossed-field discharge in a vacuum switch .... See Entry 118781

06.30C Spatial variables measurement

(inc. measurement of all variables extending in space e.g. diameter, height, thickness, displacement, surface topography, particle size, area of disperse systems)

117147 Electro-optic surface profiler. J.W.Buechele, N.B.Seebe (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.3B, p.1528-30 (Aug. 1983).
An electro-optic surface profiler for multilayer ceramic greensheet inspection is arranged to provide rapid, noncontact precision measurement of depth simultaneously with surface coordinate distances, including detecting contrasting detail or structure, its geographic location and extent. (no refs.)

117148 Characterization of backside roughness of silicon wafers by mid-IR spectrometry. K.H.Kelleher, M.V.Kulkarni (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.3B, p.1597-9 (Aug. 1983).
The roughness of silicon wafer surfaces can be accurately characterized from the mid-infrared spectrum by determining the slope of a baseline arbitrarily defined through points having nearly no absorption (1046 and 700 cm^{-1} in this case) and off-set of a similar point (1107 cm^{-1}) from its location in the spectrum of a sample with polished surfaces. (no refs.)

117149 Precision displacement measurement using a diffraction grating. S.Moriyama, T.Harada.
J. Jpn. Soc. Precis. Eng. (Japan), vol.49, no.6, p.784-8 (June 1983). In Japanese.
A new precision displacement measuring method using a diffraction grating was investigated. In this paper, the measuring principle and the experimental results are described. The measuring principle is based on an interference phenomenon. Interference fringes are produced by superposing of a pair of positive and negative order diffraction beams obtained by illuminating the grating perpendicularly with a monochromatic light beam. The displacement of the grating causes sinusoidal change in brightness of the fringes. The displacement measurement is carried out by counting the fringes photoelectronically. Experimental system was constructed by using a reflection grating with the period of 1.43 μm and a laser diode as the monochromatic light source. The measuring performance with the precision of 0.1 μm over the range of 20 mm was confirmed in the experiment. An application to two-dimensional displacement measurement is also proposed. (6 refs.)

117150 Differential thickness measurement using a polarization interferometer. V.T.Chitnis, Y.Uchida (Dept. of Electric Engng., Faculty of Engng., Nagoya Univ., Nagoya, Japan), K.Matsuura, S.Hattori.
Opt. & Laser Technol. (GB), vol.15, no.5, p.269-73 (Oct. 1983).
A method for measuring the differential thickness of a thin film using a polarization interferometer is described. Theoretical estimation shows that the measurement error is less than 0.1%. Experiments performed on a PZT sample indicate high sensitivity and excellent linearity of the system. PZT expansions ranging from 300 nm to less than 1 nm could be measured with a precision better than 0.1 nm. (8 refs.)

117151 Determination of the amplitude-frequency characteristics of a profilometer with the aid of a Michelson interferometer. C.Lukianowicz (Inst. Budowy Maszyn, Wyzszej Szkoly Inzynierskiej, Koszalin, Poland).
Pomiary Autom. Kontrola (Poland), vol.29, no.4, p.121-2 (April 1983). In Polish. [received: Sept. 1983]
The author describes a method of determining the amplitude-frequency characteristics by means of a Michelson interferometer. In the research work the stroboscopic interference method was employed. Results of examining the above mentioned characteristic of a profilometer ME-10 are detailed. (4 refs.)

117152 Spherical surface roughness measurement by means of a displacement-sensitive element. J.Siuta, H.Chojnacki, M.Rojszczak (Zaklady Mech. Gorzow, Gorzow, Poland).
Pomiary Autom. Kontrola (Poland), vol.29, no.6, p.204-5 (June 1983). In Polish.
Roughness measurements on spherical surfaces are difficult, especially when the curvature radius is small, because the profilographometers commonly used in Poland serve mainly for measurements on plane surfaces. This article presents a method of roughness measurements on spherical surfaces using a displacement-sensitive element. (6 refs.)

117153 Interlaboratory study on linewidth measurements for antireflective chromium photomasks. J.M.Jerke, M.C.Croarkin, R.N.Varner.
Report NBS-SP-400-74, Nat. Bur. Stand., Washington, DC, USA (Nov. 1982), vii+183 pp.
Optical microscopes fitted with a micrometer attachment are commonly used to measure small linewidths and other critical dimensions on integrated-circuit (IC) photomasks. The authors discuss the results of an interlaboratory study to evaluate a National Bureau of Standards (NBS) prototype calibration standard for linewidth measurements on IC photomasks and procedures for adjusting and calibrating optical-microscope systems in the 0.5- to 12-μm measurement range. Using procedures furnished by NBS, industrial participants measured line spacings and linewidths on NBS antireflective-chromium artifacts. A comparison of NBS linewidth values with participants' measurements showed that most differences were less than ±0.3 μm. A linewidth calibration significantly reduced systematic errors for most systems. (36 refs.)

Optical Sensing Techniques, Benefits, Costs .... See Entry 116915

A study on some problems of the eddy-current probes and frequency modulated circuit .... See Entry 117167

Optical sensing and engineering metrology .... See Entry 117207

On virtual fringe analysis method in focused double-exposure speckle photography .... See Entry 117219

Surface form measurement by heterodyne moire contouring .. See Entry 117220

Distribution-free estimation of sphere size distributions from slabs showing overprotection and truncation, with a review of previous methods .... See Entry 117229

Eikonal approximation to small angle light scattering from absorbing fibres .... See Entry 118080

Measurement of curvature and bending stiffness of thin carbon composite plates using holographic interferometry .... See Entry 118099

Production of deformed grating patterns by laser-scanning and some applications .... See Entry 118195

Optical sensor with fibre optic links: a shutter modulator ..... See Entry 118264

Optical fibre sensors for displacement measurement .... See Entry 118278

Holographic interferometry in vibration measurements .... See Entry 118541

Polarization effects in a layer system with elastic anisotropy .... See Entry 119088

Investigation of the surface finish of aluminium metallization by the photometry method of dissipated radiation .... See Entry 120524

Automated cavity measurement using a region-growing algorithm .... See Entry 120538

Comparative determination of the size of disk-shape colloid particles by conventional and electric light scattering .... See Entry 120682

06.30G Velocity, acceleration and rotation measurement

(for flow velocity measurement see 47.80)

117154 Theoretical foundations of a microprocessor based acceleration transducer. J.Bozicevic (Dept. of Measurement & Control, Univ. of Zagreb, Zagreb, Yugoslavia).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.115-24 vol.3
The theoretical foundations and mathematical model of a new acceleration transducer capable of sensing and measuring the acceleration in any direction are presented. One end of each of the six springs is attached to one of six less vertices of the octahedron frame, while their other ends are joined together in the centre of the octahedron frame. This joint is made as the free moving seismic mass. The springs are relative displacement sensors which give information into a microcomputer programmed to compute the vector of acceleration. (1 ref.)

06.50 DATA HANDLING AND COMPUTATION

(see also 02.70 Computational techniques; 29.80 Nuclear information processing; for optical data processing, storage and retrieval see 42.30; for geophysical data acquisition and storage see 93.65)

117155 A special-purpose microcomputer in instrumentation. M.Franc.
Jemna Mech. & Opt. (Czechoslovakia), vol.28, no.8, p.221-2 (Aug. 1983). In Czech.
On the basis of the I 8080 A microprocessor, the CI-100 integrator has been developed whose main function is processing of analogue signals from chronotographic detectors. The integrator enables real-time sampling of the chromatographic signals, their analysis and processing and printout on a thermally sensitive alphanumerical printer. Both hardware and software of the system are briefly described. (no refs.) *E.D.*

117156 A high-speed, multi-input serial-interfacing system for a computer with simultaneous back-up recording on magnetic tape. A.H.Andeweg.
Report M52, Council for Miner. Technol., Randburg, S. Africa (21 March 1983), 41 pp.
A system has been developed that interfaces nuclear-instrument data modules and a multichannel analyser into a computer. The interface converts 4-bit binary-coded decimal data into 8-bit packed BCD data, and the parallel data into serial data. The data are transmitted up to a distance of 500 m at a transfer rate of 153.6 kbaud via an RS422 transmission link to a central computer system. One or more multichannel analyser systems can be connected to the system via a routeing device which serves these analysers on a first-come-first-served mode. The data transmitted to the computer system are recorded simultaneously on a digital magnetic-tape drive to provide a back-up facility. (2 refs.)

Quantitative serial sectioning analysis: preview ... See Entry 117228

JSY-390 laser light scattering spectrometer ... See Entry 117256

A file search system for infrared spectra ... See Entry 117257

Interfacing a transit-time mass spectrometer to a minicomputer ... See Entry 117273

Some aspects of high speed mass spectrometric signal processing ... See Entry 117276

Using a microprocessor to analyse particle shape—a tutorial system ... See Entry 117288

Automation of the control of two physical experiments by M 7000 computer ... See Entry 117292

Tomographic reconstruction from a limited number of projections ... See Entry 117295

Processing system for radiographic pictures ... See Entry 117296

Multichannel amplitude analyzer using the 'MERA-60' microcomputer ... See Entry 117735

Interfacing digitized Disa anemometer output to an Apple II computer ... See Entry 118692

On the identification of numerical simulation of contrasts visible in crystalline interfaces ... See Entry 118828

Computer controlled growth of GaP by LEC technique ... See Entry 120239

Advances in surface inspection using on-line image processing ... See Entry 120588

A computer system for real-time data acquisition and analysis of biopotentials and quantal content at the neuromuscular junction ... See Entry 121059

Automated analysis of neuromuscular 'jitter' ... See Entry 121060

A fast data recording system for a rotating interferometer ... See Entry 121392

06.60 LABORATORY TECHNIQUES

117157 Sample carousel transfer mechanism. D.H.Fearon, H.F.Helbig, S.A.Steward, F.S.Uribe (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1558-60 (1983).
Describes a carousel transfer system, designed and built for use in the authors' laboratory. The system consists of four modified commercial components, a load/process chamber, a horizontal long-travel linear manipulator (LM), a 12-sample carousel, and a vertically mounted high precision manipulator (HPM) in the analysis chamber. There are 100 cm (4 in.) and 150 cm (6 in.) diam. windows facing the experimenter in the load/process chamber and the analysis chamber, respectively. These windows allow the experimenter to observe and control the carousel transfer. The window of the load/process chamber is removed to change carousels. (2 refs.)

117158 Modification of platinum carrier for micro combustion flask (Thomas-Schoniger type). H.H.Whitaker, B.L.Goydish.
RCA Tech. Not. (USA), no.1331, p.1-2 (2 Sept. 1983).
For the analysis of carbon black samples using a Schoniger oxygen combustion flask, the authors have found that the platinum carrier equipment is not adequate in two respects: samples of carbon blacks having low impurity levels cannot be made large enough for accurate analysis; and inadequate combustion occurs. They have found that by using a larger platinum carrier of much finer mesh size, larger samples of carbon black can be used which nevertheless provide complete combustion of the samples for further analysis, without advance preparation of the samples or separation of residues after combustion. (no refs.)

Quantitative serial sectioning analysis: preview ... See Entry 117228

A chemical thinning technique for transmission electron microscopy cross-sectional samples ... See Entry 117287

Flash X-ray cinematography at framing rates up to 4.10^7 images/sec: application to terminal ballistics ... See Entry 117294

A variable-temperature sample container for low-temperature neutron powder diffraction ... See Entry 117306

The recovery of organic solvents from liquid scintillation waste ... See Entry 117700

Image-converter recording of picosecond pulses emitted by an erbium laser ($\lambda = 2.94\ \mu$) with active mode locking ... See Entry 118190

Effects of sample mounting techniques on apparent polyacetylene morphology ... See Entry 118908

The use of a versatile specimen holder to prepare cultured cells for scanning electron microscopy ... See Entry 121082

06.70 GENERAL INSTRUMENTATION

117159 Basic study on foil strain gauges made of electrodeposited copper or nickel. M.Seika, Y.Nagase (Faculty of Engng., Nagoya Univ., Nagoya, Japan), K.Hosono, C.Kato.
Bull. JSME (Japan), vol.26, no.216, p.946-53 (June 1983).
In order to utilize plating foils made of acid copper and nickel as strain gauges, basic properties of the plating foils are examined under rotating bending loads. The results obtained are as follows: (1) When the final deposited surface of a nickel foil is used as the cementing surface, which is named 'the inside foil', applicable test temperatures are within the range of 100-300°C. (2) When the inside foil of nickel is preheated at a temperature slightly lower than the recrystallization temperature of the foil for a short while, it can be used even at room temperature just as the copper foil. (3) The acid copper or nickel foil consisting of one layer without a basal plating of alkaline copper can give values with sufficient accuracy. (8 refs.)

117160 GEC research—sensors. G.R.Jordan (Marconi Res. Centre, Chelmsford, England).
J. Phys. E (GB), vol.16, no.10, p.931-2 (Oct. 1983).
The commercial activities of GEC range from the consumer and industrial sectors to the advanced military, avionic and aerospace industries. In all these diverse areas there is an urgent need for new forms of sensors, sensors which have improved performance over available devices, are reliable, low cost and preferably have a digital output. The developments discussed encompass the widest possible range of sensors and include vibratory devices, optical, optomechanical, optoelectronic and optical fibre sensors, integrated semiconductor sensors, ultrasonic and materials-based devices. These programmes are supported by the extensive signal processing and microprocessor expertise within the GEC company. (no refs.)

117161 Sensors and their applications. P.A.Payne (Dept. of Instrumentation & Analytical Sci., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
J. Phys. E (GB), vol.16, no.10, p.947-51 (Oct. 1983).
A number of market surveys are used to provide guidance on the growth rates within various sectors of the sensor market. A number of economic factors are considered which will have a serious bearing on the develpment of the sensor market. The manner in which research and development organisations, and also educational institutions, will need to adapt in order to respond to these changes is discussed. (25 refs.)

117162 Sensors for mechanical properties. R.S.Medlock (Brown Boveri Kent plc, Luton, England).
J. Phys. E (GB), vol.16, no.10, p.964-72 (Oct. 1983).
The range of mechanical measurands considered include spatial variables, velocity, acceleration, mass, force and other physiomechanical qualities such as viscosity, hardness and phase concentration. Attention is drawn to the problem of terminology and classification. Transduction techniques used in a large number of sensors are described by numerous line diagrams each with a brief explanation. Some indications are given of trends in future development from which it is concluded that electronic and optoelectronic microchips could play an important role in sensor technology of the future. (6 refs.)

117163 Optical systems and sensors for measurement and control. B.Culshaw (Dept. of Electronic & Electrical Engng., Univ. of Strathclyde, Glasgow, Scotland).
J. Phys. E (GB), vol.16, no.10, p.978-86 (Oct. 1983).
The author discusses the future roles of optical fibre systems in instrumentation and draws attention to some of the potential areas in which current developments in opto-electronics may well considerably expand the applications arena. The major possibilities include the all optical sensor and actuator system, the incorporation of passive signal processing, analogue-to-digital conversion and passive delay line multiplexing, and the impact of advanced optical technology including single mode optics and integrated optic concepts. Some potential systems are described which illustrate the considerably increased role for optical techniques in instrumentation. (32 refs.)

117164 A membrane-type zero pressure-difference indicator. S.Glowka, A.Fiutkowski (Inst. Chem. Fizycznej Polskiej Akad. Nauk, Warsaw, Poland), A.Lazuchiewicz.
Pomiary Autom. Kontrola (Poland), vol.29, no.4, p.113-14 (April 1983). In Polish. [received: Sept. 1983]
The authors describe the design and operation of a zero pressure-difference indicator which permits to separate the liquid of gaseous phase from a neutral gas in pressure measurement and to indicate a pressure difference of 1.10^{-5} MPa within 0-60 MPa. (6 refs.)

117165 Radiation field of a plane waveguide into an elastic space. S.A.Fedorov, V.L.Tsvetyanskii (Rostov-on-Don State Univ., Rostov, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.100-4 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.26-32 (Feb. 1983). [received: Oct. 1983]
A study is made of the radiation field from a piezoelectric transducer plus a plane waveguide into an elastic half space, with due regard for the dispersion of the normal waves. The distortions of the radiation-field's characteristics are shown for monochromatic and pulse modes. (9 refs.)

117166 A review of mathematical modelling of instrument transducers. F.Abdullah, L.Finkelstein (Phys. Dept., City Univ. London, London, England).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.145-57 vol.3
The application of mathematical models to a range of common instruments is discussed. These include diaphragms, capsules and Bourdon tubes for pressure sensors; load cell billets for force measurement; inductive and capacitive displacement sensors; magnetic circuits for instruments; a common solenoid actuator; the orifice plate flow meter; a hydrodynamic oscillator flowmeter and a common industrial platinum resistance thermometer assembly. A computer package, MEDIEM, for modelling the dynamic response of instrument systems is also described. It is concluded that in future, mathematical models and particularly computer models will form a valuable tool to aid in instrument design and evaluation. (25 refs.)

117167 A study on some problems of the eddy-current probes and frequency modulated circuit. Fu Shang-xin, Feng Guan-ping, Lu Dao-jiang, Chen Li-ji (Dept. of Precision Instruments, TsingHua Univ., Beijing, China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.17-25
In noncontact measurement of displacement and vibration, the method of the L value measurement and the frequency modulated circuit are introduced. The equislope characteristics of the f-h curve, the correction for linearity and the compensation of thermal effect are studied both theoretically and experimentally. (3 refs.)

Theoretical foundations of a microprocessor based acceleration transducer .... See Entry 117154

A wireless extensometric torquemeter for use on rotary objects .... See Entry 117169

Thick film resistors in low-temperature resistance thermometry in high magnetic fields .... See Entry 117174

Bifilar helix hygrometer. A new fast response sensor for sampling application .... See Entry 117190

Testing of strain-gauge pressure transducers up to 3.5 MPa at cryogenic temperatures and in magnetic fields up to 6 T .... See Entry 117196

Electric and magnetic field sensor for simultaneous electromagnetic near-field measurements - Theory .... See Entry 117199

A remote-control direct-beam exposure device for the Arndt-Wonacott rotation camera .... See Entry 117301

A magnetic-induction beam current transducer with shielding from magnetic interference .... See Entry 117719

Voltage and current amplifiers in ultrasonic equipment .... See Entry 118340

Application of a new velocity gage to fraction at high crack velocities .... See Entry 118537

A technique using a Wheatstone bridge to study the minute differences in nucleation and growth of two metallic films .... See Entry 119359

Microwave eddy-current transducers for monitoring metals ... See Entry 120551

Eddy current measuring devices for automatic detection of material defects in strands during the casting process .... See Entry 120586

07.00 SPECIFIC INSTRUMENTATION AND TECHNIQUES OF GENERAL USE IN PHYSICS

(see also within each subdiscipline for specialized instrumentation and techniques)

07.10 MECHANICAL INSTRUMENTS AND MEASUREMENT METHODS

(for measurement in the mechanics of solids and rheology, see 46.30R; for materials testing, see 81.70)

117168 Study on vibratory movers. Moving velocity and control of moving direction. S.Okabe, Y.Yokoyama.
J. Jpn. Soc. Precis. Eng. (Japan), vol.49, no.6, p.789-95 (June 1983). In Japanese.
Treats the method of moving a particle by means of vibratory actuator which is attached to the particle. These devices are named vibratory movers. When a particle is moved without jumping on a sliding surface, the motion of the particle is represented by the combinations of three basic motions, i.e. positive slip, negative slip and stick motion. Therefore the moving velocity of the particle is not uniform throughout one period of vibration due to intermittent sticking and slipping motions, and the mean moving velocity must be calculated. The vibratory movers are classified into three types according to the structure. They are direct actuated type, multidegrees-of-freedom type and electromagnet type. In this paper, the direct actuated type and two-degrees-of-freedom type are discussed analytically. In the direct actuated type, the equations of motion of the particle are similar to those of vibratory conveying. The relations between moving conditions and moving velocity are shown by various diagrams, and the optimum moving conditions are considered. The control methods of moving direction are discussed also. It has been confirmed that the above theoretical results agree well with experimental ones. (4 refs.)

117169 A wireless extensometric torquemeter for use on rotary objects. T.Sidor (Akad. Gorniczo-Hutniczej, Krakow, Poland).
Pomiary Autom. Kontrola (Poland), vol.29, no.4, p.125-6 (April 1983). In Polish. [received: Sept. 1983]
The author describes an extensometric torquemeter with a wireless power supply to the system. The measurement signal converted into frequency by a miniature electronic converter which rotated together with the strain-gauges, modulates through a change of loading the voltage across the stationary winding of the transformer which also serves as a power supply to the converter circuit. The signal obtained after a double demodulation (amplitude and frequency) is converted into a voltage proportional to the torque being measured. (4 refs.)

Stationary motion of a gyrostat with deformable plates and its stability in a Newtonian central force field .... See Entry 118384

07.20 THERMAL INSTRUMENTS AND TECHNIQUES

(see also 44.50 Thermal properties of matter, 44.60 Thermodynamic processes; for radiometry and detection of thermal radiation see 07.60D and 07.62)

117170 Thermal microscopes. M.Luukkala.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.103-7 (1983).
The authors describe the principles behind a so called thermal microscope, where thermal waves of a short wavelength are used to probe the surface of various materials. Surface and subsurface cracks, delaminations and various coatings and surface layers can be detected with the thermal microscope. In particular, the surface thermal waves are a quite sensitive to surface flaws. The author has measured the depth of surface hardened steel with the present instrument. (2 refs.)

117171 Thermal wave piezoelectric and microphone detection for nondestructive evaluation: a comparison. G.Busse (ZWE Phys., Hochschule der Bundeswehr Munchen, Munchen, Germany), A.Rosencwaig.
J. Photoacoust. (USA), vol.1, no.3, p.365-9 (1982-1983). [received: Oct. 1983]
Results are presented for thermal wave imaging based on piezoelectric and microphone detection. It is found that both for signal phase and magnitude imaging the depth range is larger with piezoelectric detection. (12 refs.)

117172 A method for analysing the heat conductivity of ceramic porous materials. Z.Ignaszak (Politech. Poznanskiej, Poznan, Poland).
Pomiary Autom. Kontrola (Poland), vol.29, no.6, p.190-2 (June 1983). In Polish.
The significance of investigating the thermal and physical properties of ceramic porous materials, especially their heat conductivity VS temperature is discussed. The author describes the instruments and a station for investigating heat conductivity, presents the results of tests and an original way of interpretation of the curves of isothermic surfaces, included in calculations of the heat conductivity coefficient. (7 refs.)

117173 Elements of thermography for nondestructive testing. J.Cohen.
Report NBS-TN-1177, Nat. Bur. Stand., Washington, DC, USA (May 1983), vi+28 pp.
Presents an elementary review of thermal imaging systems, with emphasis on the application of thermography to nondestructive testing. Topics discussed include heat radiation theory; early and contemporary thermal imaging systems; performance characteristics; effects of emissivity, background temperature, atmosphere, and field of view. Examples of various applications of thermography to nondestructive testing are given. A bibliography is included. (22 refs.)

Scanning radiometer for calibrating thermal imager test targets .... See Entry 117215

The accuracy of heat conductance measurements with cylindrical samples .... See Entry 118361

Analysis of mechanical-draught counterflow air/water cooling towers .... See Entry 118368

Mean temperature difference in multipass crossflow .... See Entry 118369

Heating unit for high-temperature mechanical tests .... See Entry 120529

07.20D Thermometry

117174 Thick film resistors in low-temperature resistance thermometry in high magnetic fields. N.Koppetzki (Zentralinst. fur Festkorperphys. und Werkstofforschung, Akad. der Wissenschaften, Dresden, Germany).
Cryogenics (GB), vol.23, no.10, p.559-61 (Oct. 1983).
Thick film resistors exhibit a strong dependence on temperature in the cryogenic range below 20K. In this range the temperature coefficient of resistance is estimated to be comparable to that of commonly used resistance thermometers. The resistance change by the action of the magnetic field is observed to be only small and independent of magnetic field direction. By using these resistors in cryogenic resistance thermometry in intense magnetic field the temperature error due to the magnetoresistance is shown to be only small in comparison with frequently used sensors. According to these results thick film resistors are reported to offer an interesting alternative in cryogenic resistance thermometry within intense magnetic fields. (8 refs.)

117175 Nanokelvin thermometry at temperatures near 2K. V.Steinberg, G.Ahlers (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA).
J. Low Temp. Phys. (USA), vol.53, no.1-2, p.255-83 (Oct. 1983).
Presents a method of temperature measurement based on a liquid ^{3}He vapor pressure thermometer with a resolution of one part in 10^9 of the absolute temperature over the range from 1.6 to 2.2K. The thermometer, as well as apparatus suitable for the assessment of the resolution and stability of the device, are described in detail. A method for the determination of a fixed point on the temperature scale with a resolution of 2×10^{-9} is presented. Two different procedures for monitoring the long-term stability of the thermometer are discussed. The present resolution and stability of the thermometer are an improvement by two orders of magnitude over conventional germanium resistance thermometry. Although this performance level is adequate for presently planned phase transition experiments using liquid ^{4}He, future improvements by yet another order of magnitude seem feasible and will bring the device within an order of magnitude of the thermal noise limit. (34 refs.)

117176 Digital temperature gauge for your car. F.L.Young,Sr., F.L.Young,Jr..
Radio-Electron. (USA), vol.54, no.8, p.92-5 (Aug. 1983).
Describes the design of a digital thermometer that can be used to monitor the car's engine temperature. The design is based on the CA3161E and the CA3162E ICs. A schematic of the thermometer is shown. CA3162E, a dual-slope, dual-rate ADC translates an incoming analog signal into a digital BCD number, then CA3161E (a BCD-7-segment decoder/driver) converts that number into signals which lights up the display. The power for the entire circuit is derived from a 340T-5 five-volt regulator. The temperature probe is a diode attached to the end of a coaxial cable. (no refs.)

117177 Determination of detector dependent radiation factors in an infrared image creating system. N.Bacso (Service of Heat Process Control, Hungarian Electricity Board, Budapest, Hungary).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.483-92 vol.1
The physical relationships of temperature measurement based on infrared radiation are outlined. Measuring uncertainties from wavelength dependence of radiation coefficients and of detector sensitivity are pointed out. A new measuring method is presented, along which the image creating temperature

measuring instrument itself can be used in industrial practice for measuring the radiation coefficients with sufficient accuracy, and for determining the well-defined tolerances thereof. (5 refs.)

117178 Instrument for the measurement of transient temperature (IMTT)—an apparatus for automatic correction of transient and radiative errors of the thermocouple. Zhu Dezhong, Cui Xiaomin (Dept. of Engng. Mech., Tsinghua Univ., Beijing, China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.27-33
When the fluctuating temperature of a hot gas stream is measured by means of a thermocouple, it is necessary to correct the transient and radiative errors. The IMTT is based on the thermal equilibrium equation for the hot junction of the thermocouple, and can be used to correct the above mentioned errors according to the measured values of the hot junction temperature and the gas stream velocity. The error-corrected temperature value is displayed on a digital voltmeter and is plotted out by a recorder. The IMTT can be used to measure the temperature field by the fast sweep method, the fluctuating temperature by the fixed position method and temperatures that exceed the melting point of the thermocouple materials with an injection thermocouple. (3 refs.)

117179 Update on the versatility of infrared thermometry. M.M.Everest (Everest Intersci., Tustin, CA, USA).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.431-40
Discusses advances in the state-of-the-art of infrared thermometry which have expanded the versatility of non-contact infrared thermometry. The breakthrough of the capability of reading temperatures with 0.1°C precision and ±0.5°C accuracy instantly, coupled with intra-optical light sighting and microscopic capabilities, have opened the doors of infrared thermometry to many additional markets. The ability of infrared thermometers to read the temperature differential between the ambient air temperature and the absolute temperature of the intended target automatically, has further expanded their capabilities. The areas where infrared thermometry can be used are indicated. (23 refs.)

In situ calibration of nuclear plant platinum resistance thermometers using Johnson noise methods .... See Entry 117644

07.20F Calorimetry

Metal carbonyl bond strengths: applications of photoacoustic calorimetry .... See Entry 120651

07.20K High-temperature techniques and instrumentation; pyrometry

117180 Measurement methods of emission factors between 200 and 1500°C. F.Millet (Dept. Materiaux et Procedes, SNECMA, Suresnes, France).
Rev. Gen. Therm. (France), vol.21, no.251, p.879-91 (Nov. 1982). In French. [received: Oct. 1983]
SNECMA has developed methods for measuring the radiative properties of materials for their application to industrial problems (temperature determination and heat balances). The author describes the measurement of the normal monochromatic emission factor of a material from 200 to 1500°C, for a mean pyrometer wavelength centered around 0.65 μm or 2.2 μm (equipment with built-in black body); the measurement of the directional monochromatic emission factor from 250 to 750°C for a mean pyrometer wavelength centered around 2.2 μm (equipment with reference coating); measurement of the total hemispheric emission factor from 200 to 1500°C. The author points out the basic assumptions made (opaque material; emissivity independent of wavelength and direction in the pyrometer wavelength band; equal monochromatic emissivity and absorptivity at a certain temperature) and discusses the principle of the method, the measurement system, the field of application and the limitations, as well as accuracy. He also describes the calibration of the pyrometers employed. (no refs.)

117181 Optical pyrometry in steel industry. G.Heitz, J.Philippe (Inst. de Recherches de la Siderurgie Francaise, IRSID, Saint-Germain-en-Laye, France).
Rev. Gen. Therm. (France), vol.21, no.251, p.893-9 (Nov. 1982). In French. [received: Oct. 1983]
The authors show the importance of this temperature measurement technique which is utilised in nearly all the sectors of steelmaking and most particularly in the following fields: reheating furnaces, rolling mills and blast furnaces. The text mentions problems generally encountered by the operators like partial misreading of the emissivities or very hard environment. The solutions proposed by the twenty-six optical pyrometer, tradesmen present on the French market are briefly introduced. Finally the text describes the IRSID contribution to the optical pyrometry evolution by its active collaboration with ministerial or private organisms, the development of its own work like the creation of reference laboratories, evaluation of pyrometer performance, adaptation of new products, formation of technicians and engineers to this technique. (no refs.)

117182 Microcomputer-controlled cooled optical pyrometer with 15 sensors for adverse operating conditions. J.Weber, A.Fabiunke (AEG-Telefunken, Berlin, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.455-62 vol.1
Describes a microcomputer-controlled optical pyrometer which was developed for the measurement of high temperatures within a range of 700 up to 1500°C, and which is to be installed in the field of continuous costing plants with rough environmental conditions. Special features, i.e. functional, mechanical and electronic design of the measuring device as well as program flow and technical details in realisation are emphasized. (no refs.)

07.20M Cryogenics

117183 Large-scale applications of dilution refrigerators. T.O.Niinikoski.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.144-51 (1983).
The author discusses the optimum design of dilution refrigerators and their large-scale applications in cryopumping, gravitational radiation antennas, polarized targets, neutrino telescopes, and in the production of stable atomic hydrogen or deuterium for intense polarized atom and ion beams. These beams might be useful in polarized plasma fusion reactors. (13 refs.)

117184 Thermal impedance of pressed contacts at temperatures below 4K. K.-H.Yoo, A.C.Anderson (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Cryogenics (GB), vol.23, no.10, p.531-2 (Oct. 1983).
Enhancement of thermal resistance at mechanical contacts between cryogenic components by using a thin plate of sapphire is described. (13 refs.)

117185 Cryostat for testing luminescence and radiation absorption in ionic crystals. T.Halaczek (Polish Acad. of Sci., Wroclaw, Poland), W.Jelenski, A.Niklas, R.Wiechula.
Cryogenics (GB), vol.23, no.10, p.533-4 (Oct. 1983).
A cryostat is described whose construction makes optical and X-ray examination of cryostals possible within the temperature range 70-500K. The cryostat is equipped with two quartz glass windows, one metallized mylar window, and a sorption pump which allows an integral vacuum of the order of 10^{-3} Pa to be maintained during measurements. A handle allows specimens to be turned by 180° so that an optimum position is obtained in relation to the window. (1 ref.)

117186 On the factors affecting the performance of a continuous flow cryostat. B.R.Madhu, P.S.Narayanan (Dept. of Phys., Indian Inst. of Sci., Bangalore, India).
Indian J. Cryog., vol.8, no.2, p.91-4 (1983).
A continuous flow cryostat is known to have several advantages over a dewar cryostat. It is better suited where temperature adjustment over a wide range is necessary. A continuous flow cryostat was therefore designed for the temperature range 80K to 300K for the study of dielectric and thermal expansion behaviour of solid samples, which has to be done at high vacuum (about 10^{-5} torr). In the cryostat fabricated for such studies, temperatures up to 150K could be reached by increasing the opening of a control valve near the suction pump. Further opening of the valve for obtaining temperatures lower than 150K revealed a slow oscillation of temperature in the range between 150K and 125K. A possible reason for the same is given and the three methods tried out for avoiding the temperature oscillations are explained. With suitable modification, the cryostat was found to be capable of operation in the desired range satisfactorily. (6 refs.)

117187 Unsteady state heat transfer in superinsulated liquid nitrogen dewars. S.Arunachalam, S.Jacob, S.K.Rengan, R.Srinivasan (Dept. of Phys., Indian Inst. of Sci., Bangalore, India).
Indian J. Cryog., vol.8, no.2, p.99-102 (1983).
The unsteady state heat transfer and temperature distribution of a superinsulated liquid nitrogen storage dewar has been studied and the results are analysed based on the simple conduction model of heat transfer. The short time behaviour of the evaporation rate is estimated and compared with experimental data. The contribution of radiation heat transfer is evaluated from the steady state temperature distribution of multilayer insulation. Preliminary experimental results on the in-situ treatment of adsorber material for improving its adsorption capacity is discussed. (3 refs.)

117188 Heat transfer and temperature profile studies in cylindrical cryogenic glass dewars. S.Arunachalam, S.Jacob, S.K.Rengan, R.Srinivasan (Dept. of Phys., Indian Inst. of Sci., Bangalore, India).
Indian J. Cryog., vol.8, no.2, p.103-7 (1983).
The heat transfer components and inner wall temperature profiles of a cylindrical, cryogenic glass dewar have been studied as a function of the level of liquid nitrogen in the dewar. The study shows that the gas conduction heat transfer is further enhanced with fall of liquid level in the dewar, due to the increase in interspace gas pressure. A simple analysis based on Corruccini's gas conduction equation is presented for the explanation of the observed gas conduction heat transfer. The inner wall temperatures are found to be nearly linear, except in the regions close to the liquid surface. (4 refs.)

Thick film resistors in low-temperature resistance thermometry in high magnetic fields .... See Entry 117174

Nanokelvin thermometry at temperatures near 2K .... See Entry 117175

Testing of strain-gauge pressure transducers up to 3.5 MPa at cryogenic temperatures and in magnetic fields up to 6 T .... See Entry 117196

The Reststrahlen phenomenon and liquid helium cooled far infra-red crystal detector .... See Entry 117235

A simplified sample cooling system for X-ray diffraction experiments .... See Entry 118817

Measurement of the transient heat transfer to liquid helium from a thin metal film .... See Entry 119290

The mounting of samples of filamentary A15 superconductor for J_c tests .... See Entry 119797

A deposition aid for matrix isolation studies .... See Entry 120262

Development of a cryoprobe suitable for gynaecological applications .... See Entry 121049

07.25 HYGROMETRY

117189 Moisture measurement simplified by electronics. A.Girschweiler (Microtecnic, Lausanne, Switzerland).
Microtecnic (Switzerland), no.3, p.45 (1983).
Easy-to-operate electronic hygrometers which can be calibrated by unskilled assistants and need little or no maintenance can now tackle virtually any problem involving measurement of the moisture content of dry gases. Instruments and sensors can take single- or multi-channel measurements and provide alarms or permanent records. They can operate under normal conditions, at high pressures or in hazardous areas and may also be portable, in-line and/or weatherproof. High-capacitance moisture-sensors provide continuous output readings at mains frequency without the use of amplifiers. The author describes four basic interchangeable sensors for dewpoints between −80°C and +20 °C and a chart for the calculation of moisture equivalents. (no refs.)

117190 Bifilar helix hygrometer. A new fast response sensor for sampling application. W.Leisenberg, T.Gast (Inst. fur Mess- und Regelungstech., Tech. Univ. Berlin, Berlin, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.87-94 vol.3
The incentive for the development and the field of application for the presented sensor are explained. After representation of the basic process of measurement the mechanical and electronic components of a prototype with their respective function are described. The influences on the attainable accuracy are discussed. (2 refs.)

07.30 VACUUM PRODUCTION AND TECHNIQUES

(inc. pressures below 1 atmosphere; see also 47.45 Rarefied gas dynamics; 81.15G Vacuum deposition)

117191 A simple, controllable source for dosing molecular halogens in UHV. N.D.Spencer, P.J.Goddard, P.W.Davies, M.Kitson, R.M.Lambert (Dept. of Phys. Chem., Univ. of Cambridge, Cambridge, England).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1554-5 (1983).
An electrochemical source for the reproducible generation and dosing of halogens in UHV systems is described. This approach minimizes corrosion damage to vacuum hardware and lends itself to the study of both submonolayer and multilayer halogen adsorption. The corrosive action of halogens on ultrahigh vacuum components has necessitated the development of molecular halogen beam sources, which allow in situ generation and dosing of fluorine, chlorine, bromine, and iodine, with a negligible increase in vacuum chamber background pressure. This communication describes the chlorine and bromine sources developed and routinely used in the authors' laboratory. Iodine dosing may be accomplished using a source of similar design. Fluorine, however, because of its highly reactive nature, requires a somewhat different design of source, such as that recently described in detail by Bechtold (1981). (13 refs.)

117192 A simple and efficient internal heater for baking vacuum systems. A.D.LeGrand, E.F.Greene (Metcalf Chem. Labs., Brown Univ., Providence, RI, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1556-7 (1983).
A simple and convenient method for baking a vacuum system is described which requires less power and shorter bakeout time as compared to conventional baking methods. (3 refs.)

117193 World-wide directory of manufacturers of vacuum plant, components and associated equipment—1983. B.Halliday.
Vacuum (GB), vol.33, no.8, p.457-96 (Aug. 1983).
This Directory has been compiled from the answers to questionnaires sent to nearly 500 companies world-wide. There are 20 countries represented with more than 200 entries. The Directory is divided into countries and where applicable an index by component is available. All companies have their full name, address, telephone and telex numbers (where provided by the company). The three major sections for Australia, United Kingdom and United States have the company products tabulated, but the other countries with a less extensive number of entries have been set out with the products listed under the manufacturers' name. Where a large international company is mentioned, the products are shown under that company's home country only to which reference can then be made. A full index to companies' addresses is included at the end. (no refs.)

Sample carousel transfer mechanism .... See Entry 117157

Friction and wear in ultra high vacuum a contribution to tribology .... See Entry 120450

07.30C Vacuum pumps

117194 VAROVAC rotary-vane vacuum pumps for multiple use. H.-P.Berges, G.Knorr, H.Litterscheid, G.Oswald (Leybold-Heraeus GmbH, Koln, Germany).
Vak.-Tech. (Germany), vol.32, no.6, p.174-9 (Sept. 1983). In German.
Modern process technology requires versatile vacuum pumps suitable for industrial applications and meeting the ever increasing demands with respect to high reliability in operation, low operating cost, easy maintenance, low environmental pollution, low noise level, low ultimate pressure, high pumping speed and compact construction. At the example of the VAROVAC S 630 F it is shown how these requirements were met by the development of a comprehensive pump series of new engineering concept based on the well-proved design of directly driven, oil-sealed rotary vane vacuum pumps. The essential constructional features are explained, such as forced lubrication, airing/isolation valve, integrated exhaust (oil mist) filter, isolated, greased bearings, low noise level and integrated operation controls. (no refs.)

07.30D Vacuum meters

117195 A new axial-emission self-modulating UHV ion gauge. J.Z.Chen (Shanghai Electronic Vacuum Device Inst., Shanghai, China), C.D.Suen, Y.H.Kuo.
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.245-9
An axial-emission self-modulating ultra-high vacuum ion gauge (AESMG) based on the developments of the axial-emission ion gauge (AEG) is described. The self-modulation technique used in the AESMG operates by means of changing the potential of the collector. The AESMG has some advantages such as high sensitivity, simplicity of structure and the fact that the modulating coefficient of soft X-ray photocurrent is almost equal to unity. The limiting measurable pressure of the AESMG is about 2×10^{-12} torr. (4 refs.)

07.35 HIGH PRESSURE PRODUCTION AND TECHNIQUES

(inc. pressures above 1 atmosphere)

117196 Testing of strain-gauge pressure transducers up to 3.5 MPa at cryogenic temperatures and in magnetic fields up to 6 T. G.Cerutti, R.Maghenzani, G.F.Molinar (Istituto di Metrologia, Nat. Res. Council of Italy, Torino, Italy).
Cryogenics (GB), vol.23, no.10, p.539-45 (Oct. 1983).
The characteristics of four commercial strain-gauge pressure transducers suitable for measurements in a temperature range from 4.2 to 293K were determined in the presence of magnetic fields up to 6 T. The highest pressure measured was 3.5 MPa. Tests showed that if the transducers are used in these conditions and no corrections are made, uncertainties up to 19% of the transducer full scale may be inherent in measurements. When such high error levels are unacceptable, the transducers must be individually calibrated under the working conditions: in this way the uncertainties in pressure measurements can usually be kept below 1% of the transducer full scale. (6 refs.)

07.50 ELECTRICAL INSTRUMENTS AND TECHNIQUES

117197 Oscillometric flow cell for measurement of conductivity and permittivity. E.Pungor, F.Pal, K.Toth (Inst. for General & Analytical Chem., Tech. Univ., Budapest, Hungary).
Anal. Chem. (USA), vol.55, no.11, p.1728-31 (Sept. 1983).
Reports on a new flow-through oscillometric high-frequency conductance microcell which is suitable for the measurement of conductivity or permittivity of streaming solutions or solvents. The electrodes of other cell are not contacting galvanically the measuring solution; thus a good stability of the electrode surface layer and consequently good reproducibility of the measurements can be ensured. The volume of the concentric flow cell can vary between 10 and 50 μL. (24 refs.)

117198 Contribution to the application of microwave radiometry in the field of remote sensing. K.Gruner, W.Keydel, H.Suss (Inst. fur Hochfrequenztech., DFVLR, Oberpfaffenhofen, Germany).
NTZ Arch. (Germany), vol.5, no.8, p.223-31 (Aug. 1983). In German.
The principal objective of microwave radiometry is the detection of natural, incoherent microwave radiation emitted from different objects. The advantages of microwave radiometry over infrared systems are mainly the all-weather capability, the possible subsurface penetration capability of microwaves and the large contrast range available. These advantages open a wide spectrum of possible applications of microwave radiometry in remote sensing. Therefore, several application areas are shown and measurement results are given as examples for various applications. (13 refs.)

117199 Electric and magnetic field sensor for simultaneous electromagnetic near-field measurements - Theory. M.Kanda.
Report NBS-TN-1062, Nat. Bur. Stand., Washington, DC, USA (April 1983), 30 pp.
Describes the theory of a single sensor to perform simultaneous electric and magnetic near-field measurements. The theory indicates that it is possible to obtain the magnetic-loop and electric-dipole currents using a loop terminated with identical loads at diametrically opposite points. The theory also indicates that it is possible to obtain an ideal load impedance for achieving equal electric and magnetic field responses of the loop. Preliminary experiments have been performed using plane waves to verify these results. (3 refs.)

117200 The development of the reference standard cells and its prediction method. Hu Yanrui (Nat. Inst. of Metrology, China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.101-7
The author presents a prediction method and a technical procedure with which 274 standard cells were produced after a long-term (5-10 years) examination and performance tests of the standard cells. The mean year drift for most of these cells is less than 0.4 μV (4×10^{-7}), which means that the performance of these cells is better than that of conventional reference standard cells. (18 refs.)

Investigation of a magnetron mass-spectrometer .... See Entry 117272

Diffusive, electrostatic, and gravitational deposition of suspensions in the entrance of a nozzle .... See Entry 118665

Measurement of the decay time constant of photoconductors .... See Entry 119664

Scanned light pulse technique for the investigation of insulator-semiconductor interfaces .... See Entry 119712

The mounting of samples of filamentary A15 superconductor for J_c tests .... See Entry 119797

07.55 MAGNETIC INSTRUMENTS AND TECHNIQUES

117201 Eddy current-induced stray magnetic field cancellation technique for B-H loop applications. R.W.Hamaker, P.J.Kobiela, F.P.Laming (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.3A, p.1285-7 (Aug. 1983).
The use of hysteresigraphic techniques to characterize the magnetic properties of both thick and thin film samples provides both a rapid and a reasonably accurate method for determining the B-H loop characteristics. (4 refs.)

117202 A clock-gaussmeter. S.Kaluza, J.Pszczola (Politech. Swietokrzyska, Kielce, Poland).
Pomiary Autom. Kontrola (Poland), vol.29, no.3, p.84-6 (March 1983). In Polish. [received: Sept. 1983]
The authors describe a new method of measuring magnetization or magnetic susceptibility of magnetic substances. This method is based on determination of the oscillation period of a pendulum with a sample having a magnetic moment in a heterogeneous magnetic field. A measuring system, which has been constructed and proved to be efficient, is presented. Operation of this system is similar to that of a clockwork one. The measuring facility of the clock-gaussmeter, with its pendulum placed in a cryostat, may be used for measurements in low temperatures. (6 refs.)

117203 On the possibility of automating a compensated permeammeter. J.R.Przygodzki (Politech. Swietokrzyskiej, Kielce, Poland).
Pomiary Autom. Kontrola (Poland), vol.29, no.4, p.110-11 (April 1983). In Polish. [received: Sept. 1983]
Operation principle of an automated compensated permeammeter is discussed. This instrument is a modification of a known permeammeter Picou-Illiovici, developed in order to eliminate the drawbacks; it can be used for testing materials in the form of straight samples of any value of the permeability. (4 refs.)

117204 Weak coupling devices in magnetometry. T.D.Clark, R.J.France.
Rev. Polytech. (Switzerland), no.8bis, p.897-903, 1015 (Aug. 1983). In French.
The theory and application of weak coupling devices in magnetometry are explained. The basic element of these magnetometers is usually called 'Quantum Interference Superconductor Device, abbreviated to SQUID. A further development is an extremely fast digital computer based on such 'Josephson' logic elements, which will also be of enormous capacity. (6 refs.) *J.S.*

117205 Inspection of the magnetic properties of carriers of magnetic recording. A.F.Reiderman (Inst. of Metal Phys., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.129-36 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.57-66 (Feb. 1983). [received: Oct. 1983]
Explains the results of elaboration of methods and of a measuring device for inspecting the magnetic properties of carriers of magnetic recording, in particular for checking inhomogeneities of magnetic parameters. It examines gene-

ral problems of measuring weak magnetic fluxes in pulsed fields, the sources of errors, ways of improving the accuracy and sensitivity of the respective means of measurement. (11 refs.)

117206 Microprocessor magnetic measuring system. B.Matrakov, L.Baeva (Dept. of Electrical Measurements, Higher Inst. for Mech. & Electrical Engng., Sofia, Bulgaria).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.479-87 vol.3
Deals with the synthesis of the structure and the development of algorithms for the microprocessor measuring system. The system is based on the Ferrometer 03 and makes use of the MC 6800 microprocessor unit. The algorithms are elaborated at a program level. (4 refs.)

Thick film resistors in low-temperature resistance thermometry in high magnetic fields .... See Entry 117174

Testing of strain-gauge pressure transducers up to 3.5 MPa at cryogenic temperatures and in magnetic fields up to 6 T .... See Entry 117196

Electric and magnetic field sensor for simultaneous electromagnetic near-field measurements - Theory .... See Entry 117199

Automation of the control of two physical experiments by M 7000 computer .... See Entry 117292

A three-coordinate pulsed magnetic analyzer .... See Entry 120547

An electromagnetic structurescope based on the Barkhausen effect .... See Entry 120549

Improving the accuracy of magnetic inspection of the mechanical properties of high-quality steel .... See Entry 120568

Possibilities of utilizing the Hall effect in the magnetic structural analysis of heat-treated steels .... See Entry 120569

Examination of the magnetic, electrical, and mechanical properties of thermoelectrode materials based on nickel .... See Entry 120570

Possibilities of the nondestructive magnetic inspection of hardness of 32Kh2NVMBR high-strength steel .... See Entry 120574

07.58 MAGNETIC RESONANCE SPECTROMETERS, AUXILIARY INSTRUMENTS AND TECHNIQUES

(see also 61.16N EPR and NMR determinations)

Heteronuclear correlation spectroscopy in rotating solids ...... See Entry 119922

07.60 OPTICAL INSTRUMENTS AND TECHNIQUES

(for radiation detection, see 07.62; for spectroscopy and spectrometers, see 07.65; for holography, see 42.40; for optical sources and standards, see 42.72; for optical lens and mirror systems, see 42.78; for optical devices, techniques and applications, see 42.80; for optical testing and workshop techniques, see 42.85; for radiation spectrometers and spectroscopic techniques, see 29.30; for radiation measurement, detection and counting, see 29.70)

117207 Optical sensing and engineering metrology. S.Bennett (Div. of Mech. & Optical Metrology, NPL, Teddington, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.376, p.2-7 (1983). (Optical Sensing Techniques, Benefits, Costs, Teddington, Middx., England, 7-8 Dec. 1982).
Techniques of optical sensing are not new to engineering metrology and optical instruments have a long history of successful application in this field. Recent advances in the application of lasers, the development of detectors and the use of computers have produced many new optical techniques for making fast, accurate measurements of engineering parameters. The benefits of improved metrology accrue from assured compliance with specifications, lower failure rates and better performance. The application of new optical techniques reduces measurement time and shortens the calibration chain. (17 refs.)

SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82 .... See Entry 116913

Optical Sensing Techniques, Benefits, Costs .... See Entry 116915

Electro-optic surface profiler .... See Entry 117147

Cryostat for testing luminescence and radiation absorption in ionic crystals .... See Entry 117185

Infrared detector update .... See Entry 117234

Low-angle laser light scattering for determination of molecular weights—an inter-laboratory comparison .... See Entry 118016

Effect of group velocity mismatch on the measurement of ultrashort optical pulses via second harmonic generation .... See Entry 118209

Compact infrared continuous zoom telescope .... See Entry 118243

Collimator with simulated eye aberrations for use in measuring the modulation transfer function (MTF) of telescopes and binoculars .... See Entry 118250

Calculation of surface-scattered optical fields in designing optical scanning devices .... See Entry 120556

07.60D Photometry and radiometry

(inc. colorimetry; see also 07.62 Detection of radiation)

117208 A new integrating raster microdensitometer.
Acta Medicotech. (Germany), vol.30, no.6, p.221-2 (Dec. 1982). In German.
The Vickers M85A, developed from the M85, is a flying spot scanning microdensitometer fitted with the optics of a Vickers M17 research microscope. The spot size is variable, the smallest diameter (0.25 μm for an objective of 100× magnification) approaching the limit of resolution of the microscope. The wavelength can be selected within the range 400-700 nm. The scanning time, fixed at 5 secs in the earlier unit, can now be varied between 1 and 16 secs. The high power microscope permits sharper focusing, and a TV camera or a photographic camera can be readily attached. Adjustments and routine measurements are simplified, the new unit having been designed to facilitate work in clinical laboratories, e.g. hormone bioassays and enzyme analysis. (no refs.) *D.J.B.*

117209 Multidimensional mapping of 178 Munsell colors. T.Indow, N.Aoki (Dept. of Psychology, Keio Univ., Tokyo, Japan).
Color Res. & Appl. (USA), vol.8, no.3, p.145-52 (Fall 1983).
In the right half of the Munsell color space from 2.5 R to 7.5 BG, 90 colors were selected, most of which were at the lightness level $V=7$, and in the left half from 2.5 BG to 7.5 R, 88 colors were selected most of which were at the level $V=4$. Of these 178 colors, 176 pairs in the right half and 185 pairs in the left half were subjected to the following color-difference judgement. Subjects, five in number, selected two grays for which the lightness difference matches a given color difference in size. Two matrices (incomplete) of color differences given in terms of V were processed by MDSCAL, and finally one configuration of 178 points was synthesized in a three-dimensional Euclidean space. Implications of the results are discussed in connection with results of previous similar studies which were based upon much smaller numbers of colors. (14 refs.)

117210 Parametric variations in a threshold color-difference ellipsoid for green painted samples. K.Witt, G.Doring (Bundesanstalt fur Materialprufung, Berlin, Germany).
Color Res. & Appl. (USA), vol.8, no.3, p.153-63 (Fall 1983).
Following the CIE guidelines for coordinated research on color-difference evaluation, a set of painted color samples was produced near the green reference color. Visual experiments were carried out by two different methods, absolute threshold and pair comparison. Perceptibility ellipsoids at and near threshold were determined for different mathematical models and for different groupings of observers. The main findings are: insensitivity to the method of optimization, inhomogeneity of the total set of answers but homogeneity within ranked observer groups, and change of volume but similarity of shape of the ellipsoids for extreme groups. Comparisons with other visual studies are discussed. (16 refs.)

117211 Influence of experimental parameters on the evaluation of color-difference ellipsoids. D.Strocka, A.Brockes, W.Paffhausen (Bayer AG, Leverkusen, Germany).
Color Res. & Appl. (USA), vol.8, no.3, p.169-75 (Fall 1983).
Using a set of red samples, the authors investigated the influence of the number of observers and samples on the accuracy of experimentally evaluated color-difference ellipsoids. The results show that an ellipsoid can be calculated with an accuracy corresponding to a mean error of calculated color differences below 10% if a set of about 50 samples is assessed 30 times by pair comparison, e.g. 15 observers twice each. (13 refs.)

117212 A national standardization program for spectrophotometry. F.W.Billmeyer,Jr. (Dept. of Chem., Rensselaer Polytech. Inst., Troy, NY, USA).
Color Res. & Appl. (USA), vol.8, no.3, p.182-6 (Fall 1983).
The Council for Optical Radiation Measurements proposes, with the collaboration of the National Bureau of Standards, to create and put into operation a national standardization program for ultraviolet, visible, and near-infrared wavelength-range spectrophotometers used for colorimetric and analytical measurements. The purpose of the program is to improve the shockingly poor performance exhibited by a large group of spectrophotometers in a collaborative reference program, shown elsewhere to correspond to about ten times poorer group accuracy than the inherent precision of the instruments. The central concept of the proposed national standardization program is to provide consistency with the NBS of a laboratory's capability for making accurate spectrophotometric measurements, in contrast to the traditional concept of the 'traceability' to the NBS of the calibration of a material standard. (17 refs.)

117213 Proposed indices of metamerism with constant chromatic adaptation. R.S.Berns, F.W.Billmeyer,Jr. (Dept. of Chem., Rensselaer Polytech. Inst., Troy, NY, USA).
Color Res. & Appl. (USA), vol.8, no.3, p.186-9 (Fall 1983).
It is proposed that when color differences or special metamerism indices calculated for several illuminants are to be correlated to appearance criteria, chromatic-adaptation transformations such as that of Nayatani et al. (1981, 1982) should be used to transform colorimetric data based on several illuminants to colorimetric data based on a single reference illuminant with a corresponding appearance space that is approximately uniform. The authors suggest that color differences, metamerism indices, and color constancy indices, calculated at constant chromatic adaptation by their proposed method, will give greater utility than indices calculated in the usual manner. A numerical example is appended showing the computations that are required. (7 refs.)

117214 Critical review of definitions of metamerism. A.R.Robertson (Div. of Phys., Nat. Res. Council, Ottawa, Ontario, Canada).
Color Res. & Appl. (USA), vol.8, no.3, p.189-91 (Fall 1983).
Some terminology in common use to describe metamerism and related phenomena is vague and confusing. This can and does lead to a lack of clarity of thought and to difficulty in understanding the phenomena. Such poor terminology cannot be supported. On the other hand, some 'textbook' definitions, although developed over many years and with much thought, have only a narrow application. Often they are theoretical rather than practical. This does not mean that they are wrong but that they are a base from which extended concepts and definitions can be developed. A clarification and expansion of terminology will enable problems to be defined in terms understandable to both color scientists and industrial colorists (see A.B.J. Rodrigues and R. Besnoy, ibid., vol.5, p.220-1, 1980). The present author's purpose is to suggest that this can be done in a modest but logical way without introducing a proliferation of new, and potentially confusing, terminology. (6 refs.)

117215 Scanning radiometer for calibrating thermal imager test targets. T.L.Williams (Sira Ltd., South Hill, Chislehurst, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.51-5 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Describes the design and performance of a radiometer working in the 8-12 μm wavelength range. The radiometer has a spatial resolution of 1 m radian and a noise equivalent resolution of 0.01°C. The main function of the radiometer is for calibrating thermal imager test facilities and in particular those used for measuring MRTD. It can be used to assess target temperature-uniformity, the effective emissivity of the targets and the zero temperature-difference errors. The radiometer operates in conjunction with a microcomputer which processes signals from the detector and from temperature sensors on a reference source to give absolute readings of the effective blackbody temperature of the target. (no refs.)

117216 Determination of the KTTs-5.048 colorimeter error when measuring the picture tube screen chromaticities. I.G.Alexandrova.
Tekh. Kino & Telev. (USSR), no.7, p.46-8 (July 1983). In Russian.
Considers some of the problems of using the C2000 colorimeter as a measurement reference means as well as the results of collating readings of several serial samples of the KTTs-5.048 colorimeter with C2000 colorimeter readings when measuring color picture tube screen chromaticities are given. (3 refs.)

117217 Distribution of external radiant fields of blackbody cavities. Chen Shouren, Chu Zaixiang, Chen Hongpan, Li Tieqiao (Precise Instruments Dept., Harbin Inst. of Technol., Harbin, China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.125-36
A new precise calculation of the external radiant field of cylindrical and conical cavities has been proposed. The outstanding advantage of this method is its flexibility for precise calculation of the integrated cavity emissivity for a detector in any geometrical configurations, especially for uncoaxial detectors. The distributions of the external radiant fields of some typical cavities have been solved by numerical integration techniques with the computer. Typical results are given. (9 refs.)

Nanosecond pulse generators for testing performance of high-speed photon counting system .... See Entry 118106

Investigation of the surface finish of aluminium metallization by the photometry method of dissipated radiation .... See Entry 120524

Analysis and design of a differential sunshine recorder .... See Entry 121404

07.60F Polarimetry and ellipsometry

117218 Use of Babinet-type compensators in large-field polariscopes. V.F.Kizhevnikov, N.M.Kolbin.
Ind. Lab. (USA), vol.48, no.12, p.1210-11 (Dec. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.12, p.51-2 (Dec. 1982). [received: Sept. 1983]
A device is described for holding the compensator in large-field polariscopes, i.e. those in which the working diameter is 300 mm or more. (no refs.)

Single material achromatic half-wave plate design .... See Entry 118251

On refractometric evaluation of properties of boundary layers of elastomers .... See Entry 120014

07.60H Refractometry and reflectometry

Particle characterization by PLM. II. Single polar .... See Entry 117231

Measurement of polarization mode coupling along a polarization-maintaining optical fiber using a backscattering technique .... See Entry 118291

Determination of nonvolatile components of complex mixtures by headspace analysis .... See Entry 120709

07.60L Interferometry

117219 On virtual fringe analysis method in focused double-exposure speckle photography. V.V.K.Karppinen (Dept. of Math. & Phys., Univ. of Joensuu, Joensuu, Finland).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.604-8 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A virtual fringe analysis method can be applied to determine displacement vectors from speckle photographs. A diminishing of the visibility shifts dark and bright fringes from minima and maxima of the cosine. Then not only the bright fringes but the dark ones do give erroneous results. The analysing geometry can increase a reduction of the visibility. The author deals with the fringe visibility of virtual fringes and its effect on the fringe shifts. (5 refs.)

117220 Surface form measurement by heterodyne moire contouring. G.T.Reid (Dept. of Industry, Nat. Engng. Lab., Glasgow, Scotland).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.376, p.8-14 (1983). (Optical Sensing Techniques, Benefits, Costs, Teddington, Middx., England, 7-8 Dec. 1982).
Limitations in the densitometric analysis of moire contour patterns have been considered. A fringe analysis method based on heterodyne detection is described. The heterodyne method is shown to be comparatively insensitive to variations in the light-scattering properties of the surface and to allow automatic differentiation between concavity and convexity. (13 refs.)

117221 Role for automatic fringe analysis in optical metrology. D.W.Robinson (Div. of Mech. & Optical Metrology, NPL, Teddington, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.376, p.20-5 (1983). (Optical Sensing Techniques, Benefits, Costs, Teddington, Middx., England, 7-8 Dec. 1982).
The role of automatic fringe analysis in optical metrology is demonstrated by reference to a number of applications. The techniques of analysis range from binary to gray-level processing, for accurate dimensional metrology and accept-reject thresholdings. Applications include speckle interferometry, position location in three axes, holographic nondestructive testing and moire interferometry. (4 refs.)

117222 Application of Moire-stripes to automatic measurement of wear of pantograph sliders. K.Wada, A.Shioya, T.Sekine (Control Engng. Lab., Railway Tech. Res. Inst., Tokyo, Japan).
Q. Rep. Railw. Tech. Res. Inst. (Japan), vol.24, no.1, p.46 (March 1983). [received: Aug. 1983]
A test was conducted in order to develop a device for automatic measurement of the wear of pantograph sliders. A moire camera was installed on the ceiling of a repair house near the entrance of a car shed, and the wear of sliders was measured went cars when in and out of the shed. (no refs.)

117223 A highly precise and highly sensitive instrument for measuring optical retardation of birefringence. Zhang Hey, Zhang Yuan, Wang Taifu, Wang chu (Peking Univ., Peking, China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.219-25
Describes an instrument with high sensitivity and high accuracy for the measurement of the retardation of the birefringence of optical materials. It is based on the principle of polarisation interference and makes use of controlled electrooptic retardation. It satisfies the needs of the optical industry. Its operation is convenient and construction is simple. The result can be indicated by means of digital display. Its sensitivity is less then 1 Å, accuracy is equal to 2 Å (for measuring from 0 to 100 Å) and less than $^1/_{100}$ (for measuring range greater than 100 Å). (3 refs.)

117224 Interference rejection by auxiliary feeds in Cassegrain earth terminals. J.Arnbak, M.H.A.J.Herben, R.A.C.M.van Spaendonk (Dept. of Electrical Engng., Eindhoven Univ. of Technol., Eindhoven, Netherlands).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.38/1-11
Presently, satellite crowding in the geostationary orbit is becoming a serious restriction on further development of operations in the communication bands. The enormous investments already made in existing earth terminals does not encourage complete antenna replacements to achieve lower sidelobe envelopes. However, at WARC-79 the E-W stationkeeping tolerance was tightened significantly (to ±0.1°). Consequently, it will become feasible to coordinate two potentially interfering satellite networks in accordance with Appendix 29 of the Radio Regulations, simply by reducing a few specific sidelobes in the respective earth terminals. This may be achieved by a much simpler retrofit of any earth terminals constraining orbit occupancy. This paper reviews progress in an ongoing study of interferometric sidelobe supression by auxiliary feeds in Cassegrain antennas. The isolation improvements are explored and related to the feed geometry, orbital spacing between satellites, and required excitation levels. The system value of this modernization option is very relevant as an interference mitigation scheme in the various satellite networks now in widespread use. (12 refs.)

Precision displacement measurement using a diffraction grating .... See Entry 117149

Differential thickness measurement using a polarization interferometer .... See Entry 117150

Determination of the amplitude-frequency characteristics of a profilometer with the aid of a Michelson interferometer .... See Entry 117151

Measurement of coherence of radiation from diffusely illuminated beam splitters .... See Entry 118070

Measurement of curvature and bending stiffness of thin carbon composite plates using holographic interferometry .... See Entry 118099

Use of the laser interferometer in the calibration of numerically controlled machine tools .... See Entry 118193

Production of deformed grating patterns by laser-scanning and some applications .... See Entry 118195

Single mode laser spectral spread repercussion in single-mode optical fiber coherent detection systems .... See Entry 118277

The theory and apparatus of laser interferometric centring .... See Entry 118314

An application of holographic interferometry to acoustical holography .... See Entry 118330

Further developments in in-plane strain measurement of rotating structures .... See Entry 118535

On a curvature based non-destructive moire technique for detecting defects in plates .... See Entry 118540

Holographic interferometry in vibration measurements .... See Entry 118541

Correlation and interferometric light scattering studies of the lens of the eye .... See Entry 120841

The geometric and Fourier transform solutions for the object-image conjugated interference field of human retina in the visual acuity examination by laser interferometry .... See Entry 120842

Eye deformation measurement by laser interferometry .... See Entry 120977

Double pulsed holographic interferometry on human beings in vivo .... See Entry 120978

Measurement of displacements introduced by extra-oral orthodontic forces on a macerated skull by means of speckle interferometry: a preliminary report .... See Entry 121065

07.60P Optical microscopy

117225 Frequency plane filtering in a microscope. B.W.Reuter (Inst. fur Angewandte Phys., Gesellschaft fur Strahlen- und Umweltforschung mbH, Neuherberg/Munchen, Germany).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.459-66 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
An opto-electronic hybrid system for automated near real-time processing of microscopic samples has been developed. Spatial frequency plane filtering techniques adapted to a commercial microscope are used for fast preprocessing. The noise problem was substantially reduced by use of either a moving point-like light source or by a spatially extended light source. Calculations and experiments show the conditions under which the influences of the extension of the source for both methods onto high-pass, band-pass and gradient filtering can be neglected. The system has been used for the automated evaluation of cytological smears and for detection of asbestos fibers in membrane filters. (11 refs.)

117226 Direct microscopic and microholographic observations of the solidification of particles from rapidly stirred melts. R.J.Smeulders (Dept. of Appl. Phys., Delft Univ. of Technol., Delft, Netherlands), F.H.Mischgofsky, H.J.Frankena.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.482-92 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A microscopic set-up to observe fast moving solidifying particles during stir casting is described. The set-up consists of a ruby laser and a frequency doubled Nd^{3+}:YAG laser, a model device of an actual stir casting apparatus filled with a transparent organic alloy, melting at a low temperature and three different recording systems. Using a neopentyl alcohol alloy as a model substance for metal alloys, the crystallization process is studied by direct observation. Pulses from both lasers are used to provide a sufficiently short exposure time to take (simultaneously) holograms, microphotographs and videorecordings of the fast moving (flow rates up to 10 ms^{-1}) small particles with sizes in the order of $10\text{-}10^3$ μm. Primarily solidified particles appear to have equiaxed dendritic shapes. The longest diameter of these particles attain a maximum for low stirring rates and high cooling rates. After a period of stirring, some of the dendrite tips grow and transform the particle shapes into more spherical ones. At this stage the morphology of the solidified particles shows a good similarity with stir casted metal alloys. (17 refs.)

117227 **Speckle in confocal scanning optical microscopes.** E.R.Mendez (Blackett Lab., Imperial Coll., London, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.632-6 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).

Using a 'free' propagation model, the author examines the statistical properties of speckle patterns in confocal scanning optical microscopes. Both reflection and transmission geometries are considered. Expressions for the contrast in both in and out of focus planes are derived in terms of the statistical parameters of the rough surfaces and the geometry of the optical system. The results are evaluated numerically and compared to experimental data. (8 refs.)

117228 **Quantitative serial sectioning analysis: preview.** R.T.DeHoff (Univ. of Florida, Gainesville, FL, USA).
J. Microsc. (GB), vol.131, pt.3, p.259-63 (Sept. 1983).

Quantitative serial sectioning analysis provides all of the geometric information that is available from ordinary stereological analysis. In addition, it circumvents the weaknesses inherent in geometric models that are used to estimate distribution functions and topological properties. It further makes accessible some geometric aspects of microstructures that are not available stereologically, even with model assumptions. At the present state of the art it requires a prodigious effort to prepare and analyse a single sample from a single specimen. However, the current generation of image analysing computers already has the capability of automating data collection and analysis, and there is reasonable potential for automating the sample preparation procedure. Quantitative serial sectioning analysis would render obsolete all of the elegant geometrical probability arguments of stereology. Is it the wave of the future?. (17 refs.)

117229 **Distribution-free estimation of sphere size distributions from slabs showing overprotection and truncation, with a review of previous methods.** L.M.Cruz-Orive (Anatomical Inst., Univ. of Berne, Berne, Switzerland).
J. Microsc. (GB), vol.131, pt.3, p.265-90 (Sept. 1983).

A distribution-free method is presented for unfolding the size distribution of an aggregate of disjoint opaque spherical particles in a translucent medium, from the circular profiles observed in the orthogonal projection of sections of a certain thickness through the medium. This situation pertains especially to light and transmission electron microscopy. The model accounts for overprotection (or 'Holmes effect') due to section thickness, and for two forms of truncation (or 'missing profiles' mechanisms), simultaneously. The profile data may be grouped into an arbitrary class system, chosen by the user, and the procedure can be programmed in a medium-size desk calculator. In order to incorporate the above features, however, the authors had to choose a finite-difference unfolding algorithm, the advantages and disadvantages of which are discussed in the context of the main alternative unfolding procedures hitherto available. The performance of the method is tested against three sets of real data previously analysed by a maximum likelihood method (Keiding et al., 1972). (61 refs.)

117230 **Spindle stage studies on HMX and AP.** J.A.Kohlbeck (Hercules Inc., Aerospace Div. Magna, UT, USA).
Microscope (USA), vol.30, no.4, p.249-57 (Fall 1982). [received: Sept. 1983]

Demonstrates the application of the spindle stage technique described by Bloss (1981) of measuring the optical orientation of crystals with respect to wavelength of light. These measurements were made on the polymorphs of HMX for three different wavelengths. The other example for Excalibr's use was ammonium perchlorate (AP). The spindle stage is a versatile accessory for the polarizing microscope which enables optical constants to be measured on crystalline material with good accuracy. This method is of particular advantage where only fragments of crystalline material may be available for analysis or when it is necessary to measure inclusions in crystals. (4 refs.)

117231 **Particle characterization by PLM. II. Single polar.** W.C.McCrone (McCrone Res. Inst., Chicago, IL, UISA).
Microscope (USA), vol.30, no.4, p.315-3 (Fall 1982). [received: Sept. 1983]

For pt.I, see ibid. vol.30, no.3, p.185 (1982). Use of a single polar permits the observation of pleochronism rather than average color and individual refractive indices rather than an average index. It is essential that the vibration direction of the polar be known and accurately oriented with (usually) the East-West crossline. All of the various operations using dispersion straining then become possible. These include measurement of the matching wavelength as a function of crystallographic direction, quick determination of relative index or particle and liquid and measurement of n_F, n_D and n_c for each index direction. (no refs.)

117232 **Studies on optical properties of confocal scanning optical microscope using pupils with radial transmission ρ^n distribution.** A.M.Hamed, J.J.Clair (Ecole Nat. Superieure de l'Electronique et de ses Applications, Cergy, France).
Optik (Germany), vol.65, no.3, p.209-18 (1983).

The coherent Point Spread Function (PSF) of a parabolic variant radius of amplitude pupil has been calculated for a Confocal Scanning Optical Microscope (CSOM). A general formula, in polar coordinates (ρ,θ), is given to evaluate the coherent PSF (amplitude transmission has ρ^n distribution, where n is an even number). Also, the coherent PSF of phase aberrated pupils with parabolic amplitude and phase variations in the case of CSOM, has been calculated. Results are presented for both circular phase pupils and linear amplitude phase pupils. The results of calculations, for amplitude pupils and phase aberrated pupils, are shown graphically and a comparison is made between the authors' results and the results for uniform circular and annular pupils. (19 refs.)

Interlaboratory study on linewidth measurements for antireflective chromium photomasks .... See Entry 117153

A new integrating raster microdensitometer .... See Entry 117208

Investigation of the surface finish of aluminium metallization by the photometry method of dissipated radiation .... See Entry 120524

Recent advances in laser fluorescence microscopy .... See Entry 121063

Unbiased linear property estimation for spheres, from sections exhibiting overprojection and truncation .... See Entry 121073

07.62 DETECTION OF RADIATION (BOLOMETERS, PHOTOELECTRIC CELLS, I.R. AND SUBMILLIMETRE WAVES DETECTION)

117233 **Spectral responsivity standard for infrared detectors.** L.J.Cox (Optical Systems Dept., Sira Ltd., Chislehurst, England), P.J.Key.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.46-50 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).

A preliminary report is given on the implementation of a UK National Standard for the relative spectral responsivity of infrared detectors. This will overlap with existing NPL absolute spectral responsivity standards for the visible and near infrared and will cover the spectral range from 1 to 30 micrometres with a target accuracy in the primary standard of ±1% at wavelengths up to 18 micrometres and ±2% at longer wavelengths. (5 refs.)

117234 **Infrared detector update.** M.McCormick.
Electro-Opt. (USA), vol.15, no.6, p.62-9 (June 1983).

Compares specific detectivity curves, clarifies detection parameters and lists manufacturers for infrared detectors that cover the spectral region from 1 μm out to 5 mm. (3 refs.)

117235 **The Reststrahlen phenomenon and liquid helium cooled far infrared crystal detector.** H.P.Bhattacharya (Solid State Phys. Lab., Delhi, India).
Indian J. Cryog., vol.8, no.2, p.95-6 (1983).

When ionic crystals like the alkali halides are made to vibrate in the infra-red (actually in the far infra-red region) under the action of an electromagnetic field giving optical lattice vibrations, there is strong reflection of the EM waves near the resonant frequency and this phenomenon is known as the Reststrahlen effect. This originates in the dispersion, i.e. the change of refractive index with frequency, and shows up near the resonant frequency of the ionic lattice in the region of anomalous dispersion. Through the multiple reflection by mirrors of suitable ionic material the resulting radiation after many reflections can become nearly monochromatic. Beside this customary use of the Reststrahlen effect, the phenomenon can also be used in evaluating ionic type materials like the $Hg_{1-x}Cd_xTe$ (mercury cadmium telluride) by their typical Reststrahlen bands. The above type of ternary materials have great use to-day as infra-red sensitive material in the wave length range from 2 microns to 14 microns. The Reststrahlen bands of these materials will fail in the far infra-red region where suitable crystal detectors operating at liquid helium temperatures form the most sensitive detecting devices. (1 ref.)

Elements of thermography for nondestructive testing .... See Entry 117173

Determination of detector dependent radiation factors in an infrared image creating system .... See Entry 117177

Update on the versatility of infrared thermometry .... See Entry 117179

Measurement methods of emission factors between 200 and 1500°C .... See Entry 117180

Optical pyrometry in steel industry .... See Entry 117181

Microcomputer-controlled cooled optical pyrometer with 15 sensors for adverse operating conditions .... See Entry 117182

Distribution of external radiant fields of blackbody cavities .... See Entry 117217

Nanosecond pulse generators for testing performance of high-speed photon counting system .... See Entry 118106

Analysis and design of a differential sunshine recorder .... See Entry 121404

07.65 OPTICAL SPECTROSCOPY AND SPECTROMETERS

(inc. photoacoustic spectroscopy)

117236 **A new background-correction method for atomic absorption spectrometry.** S.B.Smith,Jr., G.M.Hieftje (Instrumentation Lab. Inc., Wilmington, MA, USA).
Appl. Spectrosc. (USA), vol.37, no.5, p.419-24 (Sept.-Oct. 1983).

A new method is described and tested for background correction in atomic absorption spectrometry. Applicable to flame or furnace atomizers, the method is capable of correcting backgrounds caused by molecular absorption, particulate scattering and atomic-line overlap, even up to an absorbance value of 3. Like the Zeeman approach, the new method applies its correction very near the atomic line of interest, can employ single-beam optics, and requires no auxiliary source. However, no ancillary magnet or other costly peripherals are required and working curves are single-valued. The new technique is based on the broadening which occurs in a hollow-cathode spectral line when the lamp is operated at high currents. Under such conditions, the absorbance measured for a narrow (atomic) line is low, whereas the apparent absorbance caused by a broadband background contributor remains as high as when the lamp is operated at conventional current levels. Backgound correction can therefore be effected by taking the difference in absorbances measured with the lamp operated at high and low currents. The new technique is evaluated in its ability to correct several different kinds of background interference and is critically compared with competitive methods. (10 refs.)

117237 **Determination near the limit of detection with a sequential scanning inductively coupled plasma emission spectrometer.** D.D.Nygaard, D.S.Chase, D.A.Leighty (Instrumentation Lab. Inc., Analytical Instrument Div., Andover, ME, USA).
Appl. Spectrosc. (USA), vol.37, no.5, p.432-5 (Sept.-Oct. 1983).

Requirements associated with determinations near the limit of detection by sequential scanning inductively coupled plasma emission spectrometry are discussed. Strategies are suggested for overcoming potential difficulties, and analytical results generated using these strategies are presented for EPA Water Pollution Quality Control Samples. (6 refs.)

117238 **A design of Raman spectrograph for optical activity and normal Raman measurements.** P.L.Polavarapu (Dept. of Chem., Vanderbilt Univ., Nashville, TN, USA).
Appl. Spectrosc. (USA), vol.37, no.5, p.447-9 (Sept.-Oct. 1983).

A multipurpose Raman spectrograph employing a diode array detector and optics for collecting scattered light in two orthogonal scattering planes is described. Raman spectra representing the performance of the instrument are presented. (12 refs.)

117239 **Convective effects in thermal lens spectroscopy.** C.E.Buffett, M.D.Morris (Dept. of Chem., Univ. of Michigan, Ann Arbor, MI, USA).
Appl. Spectrosc. (USA), vol.37, no.5, p.455-8 (Sept.-Oct. 1983).

Thermally induced solution stirring can cause periodic signal fluctuations which can be the sensitivity limiting factor in thermal lens spectroscopy with a chopped pump laser. Pump and probe laser fluctuations are random, while thermal lens signals have a small periodic component caused by stirring. The problem is serious in dilute solutions because of the high solvent background absorbance. (12 refs.)

117240 Continued development of direct aerosol introduction in constant temperature furnace atomic absorption spectroscopy. D.R.Jenke, R.Woodriff (Dept. of Chem., Montanna State Univ., Bozeman, MT, USA).

Appl. Spectrosc. (USA), vol.37, no.5, p.470-2 (Sept.-Oct. 1983).

In a previous article (1983), the authors described the combination of a sample introduction/desolvation system with a Woodriff type constant temperature furnace atomizer. While the performance of the system for the determination of Ag, Cd, Zn, and Pb was characterized by a high sensitivity and reproducibility, utilization of the system described was limited to the determination of easily atomized species due to the relatively low temperatures attainable with the particular furance employed; also useful lifetime of the graphite furnace components was limited by the desolvator's inability to completely scavenge oxidizing components from the sample. Minor modifications in furnace design allow the analyst to increase the maximum operating temperature, thus expanding the applicability of the particular design while changes in the condenser design significantly increases the desolvation scavenging ability. The performance, in terms of sensitivity, reproducibility, accuracy, and freedom from simple acid matrix interferences, of this system in the analysis of aqueous samples of Ag, As, Al, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, and Zn is documented. (4 refs.)

117241 Measurement of frequency shifts using infrared or Raman difference spectroscopy. J.Laane (Dept. of Chem., Texas A&M Univ., College Station, TX, USA).

Appl. Spectrosc. (USA), vol.37, no.5, p.a474-5 (Sept.-Oct. 1983).

The author recently developed a comprehensive picture of the difference spectra expected from the use of Raman difference spectroscopy (RDS). Both frequency shifts and bandwidth changes contribute to the nature of such spectra. The RDS theory is also immediately applicable to analyzing infrared absorption bands; however, no experimental results have been presented. One reason for this is that it is inherently more difficult to obtain useful information on frequency shifts and bandwidth changes from infrared difference spectra due to the limitations on infrared absorbances. This is, it is generally impractical to work with infrared bands whose absorbances considerably exceed about 1.0 absorbance unit (less than 10% transmittance), whereas for RDS large intensities are desirable for RDS measurements. Since many strong infrared bands go 'off-scale' for pure liquids in even short path length cells, it is not practical to use infrared difference techniques to measure solvent shifts relative to the pure liquid for many samples. However, frequency differences between dilute solutions may be measured. (9 refs.)

117242 Reducing radio-frequency interference effects on emission spectrometer outputs. W.R.Kennedy (American Cast Iron Pipe Co., Birmingham, AL, USA).

Appl. Spectrosc. (USA), vol.37, no.5, p.478-9 (Sept.-Oct. 1983).

Spark excitation, and especially high voltage spark excitation, creates radio-frequency waves of sufficient intensity to cause malfunctions in nearby computers and digital readouts. The author found a simple solution to be floor-to-ceiling portable screen wire frames. These screens are electrically connected together and grounded to the equipment. They can be moved between spectrometer and readout or between spectrometer and spectrometer as the situation demands. (1 ref.)

117243 An introduction to inductively coupled plasma source mass spectrometry. A.R.Date (Inst. of Geological Sci., London, England).

TRAC Trends Anal. Chem. (Netherlands), vol.2, no.10, p.225-30 (Oct. 1983).

Inductively coupled plasma (ICP) source mass spectrometry is a revolutionary new method of analysis, combining the speed and convenience of sample introduction into the ICP with the high sensitivity and isotope ratio capability of atomic mass spectrometry. (16 refs.)

117244 New analysis methods in photon correlation spectroscopy. P.J.Nash, T.A.King (Phys. Dept., Univ. of Manchester, Manchester, England).

Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.622-31 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).

Describes the analysis of photon correlation spectroscopy decay curves by a significant new method based on the fitting of sums of positive exponentials by the S-exponential sum fitting method. The method fits a positive exponential sum to a given data set providing a best weighted least squares fit. No initial setting of any of the parameters is required and the number of exponential coefficients does not have to be preset in the program but is determined by the number of components apparent above the noise level. Results are discussed for application in scattering systems which may be single or multiple component. Systems generating single, double or multiple exponential decay functions derived from computer simulation or photon correlation experiments are considered and fitting analysis with varying noise levels. (11 refs.)

117245 New grating spectrometer with increased throughput. R.Damaschini (Lab. Aime Cotton, CNRS, Orsay, France).

Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.662-5 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).

The set-up consists of a double-grating system which realises 2 successive auto-correlations of a grille, that is to say a two-dimensional repartition of opaque and transparent zones. The flux transmission of this set-up is identical to the classical slit spectrometer but the equivalent slit height can be up to one meter for a 1 meter focal length objective. In contrast to a one-grating grille spectrometer previously proposed, no important background substraction by demodulation is needed. This system is therefore capable of operating in spectral ranges where gratings are usually used. (2 refs.)

117246 A new method of grating spectroscopy. K.Yoshihara, A.Kitade, M.Tazawa (Dept. of Appl. Phys., Nagoya Univ., Nagoya, Japan).

Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L400-2 (July 1983).

A new spectroscopic method is described which enables a radiation spectrum to be reconstructed by simultaneously measuring the intensity distribution of the Fraunhofer diffraction pattern produced by a single slit or a number of slits without separating different and overlapping orders. Computer experiments have verified the validity of the method, although ideal resolution has not yet been achieved. (1 ref.)

117247 Laser-piezoelectric-photoacoustic observation of the electrode surface. T.Sawada, A.J.Bard (Dept. of Chem., Univ. of Texas, Austin, TX, USA).

J. Photoacoust. (USA), vol.1, no.3, p.317-27 (1982-1983). [received: Oct. 1983]

Preliminary spectrometric investigations of the electrode-solution interface by pulsed dye laser-piezoelectric transduced (PZT) photoacoustic spectroscopy (PAS) are described. The deposition of the radical cation bromide ($HV^{+}\cdot Br^{-}$) formed on reduction of heptylviologen in aqueous solutions on a Pt electrode attached to a PZT was monitored and less than monolayer coverages of $HV^{+}\cdot Br^{-}$ could be detected ($S/N=1$) . The apparatus for PZT-PAS and the nature of the PAS response upon pulsed laser excitation are described. (11 refs.)

117248 Conception and realization of a photoacoustic detector for in situ spectroscopy. P.Poulet, J.Chambron (Faculte de Medicine, Inst. de Phys. Biologique, Strasbourg, France).

J. Photoacoust. (USA), vol.1, no.3, p.329-46 (1982-1983). [received: Oct. 1983]

A photoacoustic spectrometer using an open-ended detector has been developed for doing in situ measurements. It makes use of a UV light guide and a differential microphone assembled in between two identical cells, one illuminated and the other not. The characteristics of this detector are expressed in terms of sensitivity to noise ratio. The obtained results enable one to perform original applications of photoacoustic spectroscopy, especially in vivo measurements of skin optical absorption. (19 refs.)

117249 Multiplex detection in a combined laser optoacoustic spectrometer-chromatograph. V.P.Zharov (Dept. of Optoelectronics, Moscow High Tech. School., Moscow, USSR), S.G.Montanari.

J. Photoacoust. (USA), vol.1, no.3, p.355-64 (1982-1983). [received: Oct. 1983]

A multiplex scheme of detection in the laser optoacoustic spectrometer designed as a selective chromatographic detector is described. The principle of multiplex detection and its specific features are presented. The measuring setup developed utilizes three spectral channels with He-Ne, $^{12}C^{16}O_2$ and $^{13}C^{16}O_2$ lasers. The potentialities of the scheme are demonstrated by selective detection of certain alcohols in a mixture of four alcohols. Areas of application of the scheme are proposed and several modifications are discussed. (4 refs.)

117250 Separation of bulk and surface light absorption with an open photoacoustic cell. P.Helander, I.Lundstrom (Dept. of Phys. & Measurement Technol., Linkoping Inst. of Technol., Linkoping, Sweden).

J. Appl. Phys. (USA), vol.54, no.9, p.5069-75 (Sept. 1983).

A spectroscopic method for the study of adsorption of molecules onto a solid is demonstrated. It is shown in particular how the spectra of molecules adsorbed onto a solid surface and molecules in a solution outside the surface can be recorded simultaneously. The method is based on the information present in the phase of a photoacoustic signal. The experiments made to demonstrate this method were performed with an open photoacoustic cell. In this cell the temperature oscillations in the sample are transferred to a window. The thermal expansions of the window are detected by a piezoelectric crystal. Light absorbing molecules on the surface of the window and in the bulk liquid give signals with different phases that can be separated by phase sensitive detection. (20 refs.)

117251 Effect of axial injection of argon on conventional spectrochemical excitation sources at atmospheric pressure. I. Behavior of line intensities and their profiles under various experimental conditions. L.Pasky (Lenin Metall. Works, Miskolc, Hungary), I.J.Lakatos.

Spectrochim. Acta Part B (GB), vol.38B, no.8, p.1099-14 (1983).

The axial injection of argon into the conventional excitation sources through a hole drilled in the upper electrode is discussed. In spite of a simple electrode arrangement the argon produces unexpected and significant changes in emission phenomena. Self-reversal is practically eliminated. Intensity enhancements were studied as a function of line character, excitation potential, electrode type, concentration of analytes and concomitants, the presence of organic materials (solvents and solutes) and the purity of the argon. The intensity enhancement deteriorated if the concentration of excitable particles (atoms, molecules, free-radicals, etc). in the plasma increased. Using krypton instead of argon similar results were obtained. (38 refs.)

117252 Nonmetal excitation in helium, neon, and argon microwave plasmas. C.F.Bauer (Dept. of Chem., Univ. of New Hampshire, Durham, NH, USA), R.K.Skogerboe.

Spectrochim. Acta Part B (GB), vol.38B, no.8, p.1125-34 (1983).

Determines which nonmetal emission wavelengths are excited in microwave induced plasmas operated in argon, helium, and neon. Evaluation of the excitation energies associated with the nonmetal wavelengths observed relative to the energies of the rare gas metastable species which may be present in each instance indicates that collisional excitation by the rare gas molecule in the triplet state is most consistent with the data. Although this conclusion is the same as that proposed by Beenakker (ibid., vol.328, p.173, 1977) a detailed consideration shows that other excitation mechanisms may contribute to the observed spectra. (51 refs.)

117253 The capacitatively coupled microwave plasma (CMP) as atomisation source in atomic absorption spectral analysis. G.Wunsch, G.Hegenberg, N.Czech (Anorganisch-Chem. Inst., Univ. Munster, Munster, Germany).

Spectrochim. Acta Part B (GB), vol.38B, no.8, p.1135-41 (1983). In German.

The capacitatively coupled microwave plasma (CMP) with N_2 as working gas is suitable as an atomizer for atomic absorption spectroscopy. The sensitivities for Ba, Ca, Co, Cr, Fe, Mg, Mo, Ni, Sr, W and Zn are given. Their relative position in this sequence reflects the differences in the dissociation energies of the monoxides. The type of CMP used has an excitation temperature of 5600 to 4750K and a kinetic temperature of 4450K. Referring to equal optical path lengths the sensitivity in the CMP (and also in the ICP) is not better than in the 1500K 'cooler' reducing acetylene flames. A high kinetic temperature alone is not sufficient; better degrees of atomization will only be achieved if plasmas with much higher analyte residence time or with reducing chemical properties can be developed. (29 refs.)

117254 Separative column atomizer (SCA) for direct analysis by atomic absorption spectrometry. GC separation characteristics. M.Yanagisawa, H.Suzuki, K.Kitagawa, S.Tsuge (Dept. of Synthetic Chem., Nagoya Univ., Nagoya, Japan).

Spectrochim. Acta Part B (GB), vol.38B, no.8, p.1143-9 (1983).

An improved separative column atomizer (SCA) usable at higher temperatures up to 1350°C has been constructed. Emphasis is on the GC characteristics of an improved separative column atomizer (SCA) module to reduce the interferences caused by background absorption that is often unavoidable in direct analysis of practical samples. By direct ASS analysis, mercury in some organic samples has been successfully determined without background absorption due to nonatomic species resulting from the sample matrices. In the direct atomization of samples in ECTA matrix, however, complete elimination of the background absorption was not possible. Nevertheless, GC separation found in the improved SCA was effective in the measurement of the AA peak free from molecular absorption. Evidences of the GC separation were also given by the analysis of effluent gases. (10 refs.)

117255 Determination of absolute atomic concentration by the saturated vapour total absorption method. V.G.Muradov (Dept. of General Phys., Teaching Inst., Ulyanovsk, USSR).
Spectrochim. Acta Part B (GB), vol.38B, no.8, p.1151-6 (1983).
Presents a general method for determining the absolute atomic concentration in saturated vapour by means of the total absorption method. The method is based on the total growth curve and involves a correction for hyperfine structure of the spectra line and its wings. The method is applied to the resonance line of Pb(I) $\lambda=283.3$ nm, for which the growth curves for both lead of natural isotropic composition and enriched by ^{208}Pb (97.8%) have been calculated. Theoretical curves are used to determine absolute concentrations of led atoms in saturated vapour over the temperature interval 783-1113K. The experimental results are reasonably consistent with the data obtained in terms of Pb thermodynamic characteristics. (16 refs.)

117256 JSY-390 laser light scattering spectrometer. Yang Bingxin, Yang Qinglin, Zhang Haoyu, Sun Chunrong (Changchun Inst. of Appl. Chem., Acad. Sinica, Jilin, China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.183-98
The design of an optomechanical system and data collection and processing system of the JSY-390 laser light scattering spectrometer are described and discussed. Multifunction and multisignal reception are the main features. Angular resolution is 0.016° and the lowest measurable angle is 0.4°. A time resolution of 25 milliseconds is available. Data collection, translation and calculation are performed by a microcomputer. The specification of this instrument has been verified by the use of it in studying the structure of some crystalline polymers. (13 refs.)

SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82 .... See Entry 116913

Thermal wave piezoelectric and microphone detection for non-destructive evaluation: a comparison .... See Entry 117171

A national standardization program for spectrophotometry ... See Entry 117212

New methods for ruling long diffraction gratings .... See Entry 118263

Nonlinear plasma spectroscopy of the hydrogen Balmer-α line .... See Entry 118750

Laser Raman scattering spectroscopy of crystals .... See Entry 120051

A deposition aid for matrix isolation studies .... See Entry 120262

Trace element determination by atomic spectroscopic methods—state of the art .... See Entry 120687

Time-resolved electrothermal atomic absorption spectra .... See Entry 120688

Properties of the cadmium determination with the platform furnace and Zeeman background correction .... See Entry 120708

The description of detecting signals by laser scanning optoacoustic microprobe [solar cells testing application] .... See Entry 120747

Diagnostic potential of magneto-photoacoustic spectroscopy .See Entry 120976

Photoacoustic spectra of natural apatites in the near ultraviolet and visible regions .... See Entry 121214

07.65E UV and visible spectroscopy and spectrometers

Continuous wave (CW) Doppler free two-photon frequency modulated (FM) spectroscopy .... See Entry 117847

Determination of the relaxation time of the 103 H_2O vibration with an optoacoustic spectrometer and a ruby laser .... See Entry 117973

Monochromator with a plane focusing diffraction grating .....See Entry 118260

07.65G IR spectroscopy and spectrometers

117257 A file search system for infrared spectra. K.Tanabe, T.Tamura, J.Hiraishi, S.Saeki (Nat. Chem. Lab. for Industry, Tsukuba, Ibaraki, Japan), I.Suzuki, M.Tasumi.
J. Spectrosc. Soc. Jpn. (Japan), vol.32, no.4, p.241-8 (1983). In Japanese.
The search file has been created from the original data file which was constructed by compiling peak wavenumbers and transmittances in the IRDC cards. Input data of peaks and no-peak areas from a sample spectrum are compared with the file data, and a score measuring an extent of coincidence of sample and file spectra is computed for a hit spectrum in the file. Observed spectra of fifty compounds were used for a test search in order to find out a maximal condition of a search system. It is proved that the present search system has a high performance for a practical purpose. (10 refs.)

117258 Picosecond double-beam absorption spectrometer. A.V.Klevanik, V.A.Shuvalov, Yu.A.Matveets, A.V.Sharkov (Inst. of Photosynthesis, Acad. of Sci., Pushchino, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.401-3 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.655-8 (March 1983). [received: Oct. 1983]
Apparatus was constructed for investigating fast photophysical and photochemical processes resulting from selective excitation of vibronic molecular states. A single laser pulse emitted from a YAG:Nd mode-locked laser was amplified in a two-stage amplifier, frequency converted in a parametric oscillator and used to excite molecules. A pulse of the continuum was used as the test pulse. A time resolution of ±3 psec and a precision of $\pm3\times10^{-3}$ optical density units were attained in the absorption measurements carried out in a study of primary processes of conversion of the energy of light in photosynthetic reaction centers. (19 refs.)

Characterization of backside roughness of silicon wafers by mid-IR spectrometry .... See Entry 117148

Identification of vulcanized mixtures of rubbers by the IR-absorption spectrophotometry .... See Entry 120706

07.68 PHOTOGRAPHY, PHOTOGRAPHIC INSTRUMENTS AND TECHNIQUES

(for light sensitive materials see also 42.70)

117259 Autoradiography: a review of basic principles. E.J.Hahn (Health Sci. Markets Div., Eastman Kodak Co., Rochester, NY, USA).
Am. Lab. (USA), vol.15, no.7, p.64-71 (July 1983).
Autoradiography is a photographic method of recording the spatial distribution of radioisotopes within a specimen or object. Autoradiographs are accomplished by placing radioactively labeled specimens and objects in direct contact with the proper photosensitive materials. The principles of micro- and macro-techniques are outlined and the following topics are discussed in some detail: formation of autoradiographic images; choosing an exposure method for macroautoradiography; film considerations; manual and machine processing; enhancement techniques; and X-ray films recommendations. (no refs.)

117260 Fujicolor HR 100—a review. G.Ashton.
Br. J. Photogr. (GB), vol.130, no.30, p.787-9 (29 July 1983).
As the first of a new generation of medium-speed, fine-grain colour negative materials Fujicolor HR 100 film is an excellent product and one which can give even the amateur photographer who is content with $3^1/_2\times5$ in prints perceptibly superior results. As the manufacturer claims, prints, even small ones, made from Fujicolor HR 100 negatives are not only sharp and grainless but also of excellent colour quality. For more critical users who need, or prefer, to make bigger prints the superiority of the film over the existing products will be more obvious—large prints can be made from 35 mm negatives on Fujicolor HR 100 film without breakdown of the image or loss of resolution. The characteristics stem from three basic manufacturing improvements, double structure grains, latex-formulated coupler particles and improved development inhibitor releasing couplers. (no refs.)

117261 High-speed photography. J.E.Field (Cavendish Lab., Univ. of Cambridge, Cambridge, England).
Contemp. Phys. (GB), vol.24, no.5, p.439-59 (Sept.-Oct. 1983).
High-speed photography has the great advantage of giving direct visual information about transient processes. For this reason, it is finding increasing application for solving a range of industrial and scientific problems. The author reviews the techniques of high-speed photography and describes a range of applications. There are various types of high-speed camera which can operate in different speed, or framing rate, ranges. These are discussed in terms of increasing framing rate in frames per second (FPS) which illustrates the techniques and also the historical development of the subject. The applications illustrated include studies of fracture, impact, erosion, explosive initiation and laser-induced damage. (25 refs.)

117262 The all-electronic Mavica [magnetic video camera]. M.Stern.
Radio-Electron. (USA), vol.54, no.8, p.59-62,78 (Aug. 1983).
Discusses the development of a photographic system that does away with film completely. Mavica (magnetic video camera) combines electronics and electromagnetic technology into a non-silver-based photographic system. This Sony camera uses a Mavipak recording disk to store pictures. The Mavica acts much like a video recording system and uses a CCD for image conversion. The final part of the basic Mavica system is the playback unit, which converts the signals recorded on the disk into a picture that can be viewed on a TV receiver. A thermal colour video printer was also developed which is capable of taking the colour output signals of the Mavica and turning them into colour prints. (no refs.)

117263 The new disc cameras. M.Stern.
Radio-Electron. (USA), vol.54, no.8, p.63-6 (Aug. 1983).
Examines Kodak's disc cameras. There are four models available—the 3000, 4000, 6000 and 8000. Each model has a four-element, f/2.8, 12.5-mm, fixed focus lens, and two automatic exposure settings. The flash is built in and operates automatically when needed. The features of the various models are given. The major portion of the disc camera's electronics is contained in two custom ICs, the light sensing IC and the control IC. (no refs.)

117264 Auto exposure and auto focus systems. M.Stern.
Radio-Electron. (USA), vol.54, no.8, p.67-74 (Aug. 1983).
The author examines these systems which use LSI technology to combine many control functions on a single IC. One example of the state of the art in 35 mm photography is the Minolta X-700 system. It offers about every feature currently available and consists of the camera itself, an autoflash, a motor drive, a multifunction back, and a wireless remote control. Autofocus systems can be grouped into two classifications: active and passive. As an example of an active system Polaroid's 600 which uses a sonar system is included. (no refs.)

117265 Photo accessories. M.Stern.
Radio-Electron. (USA), vol.54, no.8, p.75-8 (Aug. 1983).
Reviews some photo accessories such as strobe units, light meters and spotmeters. 'Smart' strobes are available which can communicate with 'intelligent' cameras to produce high quality photos. An example of a dedicated electronic flash is the Speedlight 166A from Cannon. Built-in microcomputers and LCD readouts are some of the features available in light meters. Monolta's Spotmeter M uses microprocessor control and LCD readout, which allows the photographer to measure the lighting on an exact spot. (no refs.)

117266 Electronics in the darkroom. M.Stern.
Radio-Electron. (USA), vol.54, no.8, p.79-82 (Aug. 1983).
Discusses some of the ways in which electronics has made colour printing easier. One of the most critical factors in colour processing is the temperature of the chemicals used. To measure temperature accurately, an electronic digital thermometer like the Omega CF-20 can be used. Colour analyzers such as the microprocessor-controlled SCA 300 which can accept computer-type RAM programmable memory-modules allow the photographer to make a number of prints without having to retest, reset or reprogram anything. With the correct exposure and timing information the photographer can then program an all-electronic darkroom timer to turn on the enlarger for the correct length of time. (no refs.)

117267 The 'Kinor 16R' 16 mm hand-held film camera. E.N.Borisov, E.G.Bychko, V.F.Gordeev.
Tekh. Kino & Telev. (USSR), no.7, p.21-2 (July 1983). In Russian.
Some design features of the new Kinor 16R film camera are considered and its basic technical parameters are given. (2 refs.)

117268 A method for silver analysis of waste fixing solutions. I.Yu.Dynin, A.E.Kachanovskii, K.V.Orlov, A.P.Skakun.
Tekh. Kino & Telev. (USSR), no.7, p.27-8 (July 1983). In Russian.
Considers an improved method for quantitative determination of silver in waste fixing solutions characterised by shorter analysis time, lower consumption of chemical agents, and lower gassing while maintaining high determination accuracy. The new method differs from the previous one in that filtering of silver sulphide sediment is replaced by centrifugation. (3 refs.)

117269 The 'KOC-2' lamp for special types of film shooting. N.V.Alfimova, L.N.Krivoshi, A.M.Kuritsyn, I.N.Oskolkov, Yu.P.Pokhitonov.
Tekh. Kino & Telev. (USSR), no.7, p.29-31 (July 1983). In Russian.
The necessity of developing the lighting equipment intended for special types of film shooting is discussed, in particular for macrophotography, slow and speed motion shooting. A new lamp designed for special types of shooting is considered. (4 refs.)

117270 The effect of the emulsion layer structure on their sensitometric and structuremetric characteristics. V.V.Andreyanov, Yu.G.Oranskii.
Tekh. Kino & Telev. (USSR), no.7, p.32-6 (July 1983). In Russian.
Considers the sensitometric properties of two-layer samples and the reversal color image granularity versus the composition and structure of the emulsion

semi-layers and the concentration of color developing couplers. An attempt has been made to determine the optimum structure of zonal emulsion layers. (32 refs.)

117271 Determination of the optimum degree of color image two-dimensional contouring. O.V.Gofizen, G.K.Kupriyanova, M.D.Ruvinskii.
Tekh. Kino & Telev. (USSR), no.7, p.49-52 (July 1983). In Russian.
Experimental data of 12000 expert assessments was obtained to reveal the relationship between color image quality and a two-dimensiosal contouring degree in close-up, medium and long shots. It is shown that contouring results in a 0.7-1.1 grade increase in subjective quality assessment. (2 refs.)

Optical Sensing Techniques, Benefits, Costs ....See Entry 116915

On virtual fringe analysis method in focused double-exposure speckle photography ....See Entry 117219

Evaluating radiographic systems using the resolving power function ....See Entry 117303

Cinematography automation ....See Entry 118247

Utilisation of electronics in optical-mechanical instruments ..See Entry 118248

New generation lens systems for the Wild aviophot aerial camera system ....See Entry 118249

The theory and apparatus of laser interferometric centring ...See Entry 118314

Use of FT-41 phototechnical film in X-ray examination ....See Entry 120577

Testing and quality control of materials by microstructure analysis ....See Entry 120587

Laser speckle technique for the visualization of retinal blood flow ....See Entry 120849

A close-range photogrammetric system for 3-D measurements and perspective diagramming in biomechanics ....See Entry 121072

Microfilming of historical seismograms from the Mount Hamilton (Lick) Seismographic Station ....See Entry 121118

Use of a chromogenic film for aerial photography of erosion features ....See Entry 121250

07.75 MASS SPECTROMETERS AND MASS SPECTROMETRY TECHNIQUES

(for mass spectroscopic chemical analysis, see 82.80)

117272 Investigation of a magnetron mass-spectrometer. O.S.Kuzema, G.A.Bakai.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.52-5 (1983). In Ukrainian.
The mode of operation and main characteristics of the dynamic magnetron mass-spectrometer are described. The mass spectrometer has no geometric aberrations and permits an ionic source with 360° angular beam divergence to be used. The peculiarities mentioned provided an increase in resolution and sensitivity of the mass spectrometer. (5 refs.)

117273 Interfacing a transit-time mass spectrometer to a minicomputer. F.Ya.Gimel'shein, V.A.Ermolenko, A.N.Mikheev (Organic Chem. Inst., Acad. of Sci., Novosibirsk, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1115-18 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.5, p.69-72 (Sept.-Oct. 1982). [received: Sept. 1983]
A circuit is described for interfacing the MSKh-4 transit-time mass spectrometer to the 'Elektronika-100I' minicomputer, which permits recording of individual segments and intensities of selected mass-spectrum peaks. Six recording channels are provided, with delay time in each channel adjustable over the range 6-42 μsec. Information input into the computer is in the form of 12-bit-wide binary code. (4 refs.)

117274 Mass spectrometry of negative ions. A practical application. H.Budzikiewicz (Inst. fur Organische Chem., Univ. zu Koln, Koln, Germany).
Izv. Khim. Bulg. Akad. Nauk. (Bulgaria), vol.15, no.4, p.482-93 (1982). [received: Sept. 1983]
While mass spectrometry of positive ions has its well-established place in a modern analytical laboratory, the true value of negative ions has become evident only during the last few years, when ion sources for so-called chemical ionization become commercially available. The reason for this will become evident from a discussion of the differences between positive and negative ionization. (19 refs.)

117275 High resolution scanning secondary ion mass spectrometry (SIMS) using liquid metal field-ionization sources. A.R.Bayly, A.R.Waugh, K.Anderson (VG Sci. Ltd., East Grinstead, England).
Scanning Electron Microsc. (USA), pt.1, p.23-9 (1983). (Scanning Electron Microscopy 1983 Conference, Dearborn, MI, USA, 17-22 April 1983).
SIMS microanalysis is readily achieved by the adoption of the liquid metal field ion source for formation of the primary ion probe. These sources exhibit high brightness and small source size and permit the formation of high intensity sub-micron ion beams at low energies (≤10 keV). Operation is simple, UHV compatible and well suited to multi-technique surface analysis systems, as well as dedicated SIMS instrumentation. A 10kV gallium microprobe has been evaluated on a UHV SIMS instrument. The results presented demonstrate spatial resolution in secondary electron and secondary ion images close to 0.1 micron. A variety of samples including insulators, fractures, catalysts, polymers and integrated circuit structures have been chosen. (6 refs.)

117276 Some aspects of high speed mass spectrometric signal processing. O.S.Constandse, P.J.W.Schuyl, J.H.van den Hende (Dept. of Chem. & Chem. Engng., Delft Univ. of Technol., Delft, Netherlands).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.505-14 vol.3
Various aspects of high speed mass spectrometric signal processing are evaluated and designs are presented of both an amplifier-ADC unit and a special purpose data processing unit. The units are developed to operate as a part of a modern hierarchical gas chromatograph/mass spectrometer/computer system. The GC/MS instrument calls for data sampling frequencies up to 400000 Hz for long periods of time (up to 2 hours). By using modern hardware technologies (very fast 12 and 16-bit ADCs, bit-slice architecture) and data processing concepts (distributed processing), the high speed and capacity demands were met. (6 refs.)

Secondary ion mass spectroscopy applications in semiconductor technology: III-V compound and other material structures ....See Entry 120213

A combined instrument for the investigation of catalytic reactions by means of gas chromatography, secondary ion and gas phase mass spectrometry, Auger and photoelectron spectroscopy, and ion scattering spectroscopy ....See Entry 120672

07.77 PARTICLE BEAM PRODUCTION AND HANDLING; TARGETS

(see also 29.25 in elementary-particle and nuclear physics, 41.80 Particle beams and particle optics)

117277 An aluminum liquid metal ion source with prolonged lifetime using a sintered boride emitter. Y.Torii, H.Yamada (Atsugi Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Atsugi-shi, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L444-6 (July 1983).
A field-emission liquid Al ion source with a sintered boride emitter, such as TiB_2, BN-TiB_2 composite, has been built to prolong the utilization term of an aluminum ion beam emission. In this approach, a stable Al ion beam emission was successfully obtained for more than 100 hours without any recognizable degradation. Emission current fluctuation was less than ±1% over 1 hour for 10 μA source ion current without any feedback stabilization. Moreover, 20-30 μA/sr angular intensity at 5-10 μA source ion current, 17° emission half-angle at 10 μA source current, and a large source ion current of more than 1.5 mA were also observed. (6 refs.)

117278 A new high repetition rate shutter to obtain short molecular beam pulses. L.Wolterbeek, J.Hofstra, C.Nijhof (Dept. of Appl. Phys., Twente Univ. of Technol., Enschede, Netherlands).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1533-8 (1983).
This new shutter simply consists of a chopper wheel rotating a mere half-millimetre away from the skimmer-shaped diaphragm, which separates the source chamber from the flight tube. The repetition rate can be up to 10^4 pulses per s (width $\sim$60 μs), at an intensity of $\sim 10^{19}$ molecules/sr s, whereas existing designs yield $\sim 10^{22}$ molecules/sr s, but only at a rate of 1 pulse per 1-10 s. The design has two main advantages: since there is no gas valve, cumbersome electromechanical devices with large current pulses can be avoided. Second, one is now free to choose the nozzle parameters (e.g. p_0, T_0 and the throat diameter d_n). The beam parameters were determined by means of an electron impact detector featuring a high efficiency ionizer, thus improving the signal-to-noise ratio. (18 refs.)

117279 Beam-energy distribution measurements of liquid gallium field-ion sources. G.L.R.Mair, D.C.Grindrod, M.S.Mousa, R.V.Latham (Dept. of Phys., Univ. of Aston, Birmingham, England).
J. Phys. D (GB), vol.16, no.10, p.L209-13 (14 Oct. 1983).
Measurements are reported on the energy distribution of the ion beam produced by Ga liquid metal ion sources, for a range of emission currents, $i \sim 1$-50 μA. The full width at half-maximum (FWHM). $\Delta E_{1/2}$, of the energy distribution curves varies from $\sim$4.5-5 eV at $\sim$1 μA to $\sim$35 eV at 50 μA. Three regions can be detected in the $\Delta E_{1/2}$ versus i curve. In the first region, between $\sim$0.6 and 2 μA, $\Delta E_{1/2}$ varies very slowly with current. In the second region, above $\sim$2 μA and extending up to $\sim$25 μA, the curve rises steeply with current, in fairly good agreement with the predicted $\Delta E_{1/2} \propto i^{2/3}$ relation. For $i \gtrsim 25$ μA the curve deviates markedly from this relation, and tends to flatten. Although a tentative explanation for the deviation from theory at high currents may be given in terms of gross instabilities of the anode, the deviation at very low currents (where $\Delta E_{1/2}$ is almost constant with i) is not understood. (13 refs.)

A simple, controllable source for dosing molecular halogens in UHV ....See Entry 117191

High resolution scanning secondary ion mass spectrometry (SIMS) using liquid metal field-ionization sources ....See Entry 117275

Diagnostics of a plasma jet with grid electrodes ....See Entry 118770

07.80 ELECTRON AND ION MICROSCOPES AND TECHNIQUES

(see also in condensed matter 61.16D Electron microscopy, 61.16F Field ion microscopy)

117280 Applications of Auger spectroscopy. S.I.J.Ingrey (Bell-Northern Res., Ottawa, Ontario, Canada).
Can. J. Spectrosc. (Canada), vol.28, no.3, p.73-86 (1983).
Applications of Auger spectroscopy to resolve a wide range of materials problems has increased rapidly over the last five years. In particular, the microelectronics industry has come to rely heavily on this technique to characterize interfaces, where fractions of a monolayer of impurity may adversely effect processing or performance of integrated circuits. The Auger technique has also been successfully applied to many metallurgical problems. These two areas, among others, are reviewed along with a brief historical background, fundamentals of the technique and a few successful applications in the author's laboratories. (137 refs.)

117281 New high resolution electron spectrometer for surface vibrational analysis. L.L.Kesmodel (Dept. of Phys., Indiana Univ., Bloomington, IN, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1456-60 (1983).
The design and performance of a new electron spectrometer for high resolution electron energy loss (EELS) analysis of surface vibrations is described. Based on the 127° cylindrical deflection analyzer (CDA), the spectrometer incorporates a two-stage monochromator, a new lens system with out-of-plane focusing, relatively large (60 mm) energy-dispersing elements, and stringent magnetic field attenuation. Basic spectrometer geometry is compatible with commercial surface analysis systems employing Auger electron spectroscopy (AES), photoelectron spectroscopy (ESCA), low energy electron diffraction (LEED), etc. Performance of the instrument is shown to equal or exceed that of other spectrometers in terms of monochromatic current for a given energy resolution. An overall system resolution of 3.5 meV (28 cm^{-1}) FWHM is routinely achieved at 1.5×10^{-10} A incident current and high signal levels (10^5-10^7 cps) for elastic beam reflection. A higher resolution of 2.5 meV (20 cm^{-1}) has been obtained but with substantial sacrifice of signal level. Performance of the spectrometer is illustrated for the cases of direct (potential barrier) reflection from a palladium (100) crystal surface and for carbon-monoxide adsorption. (23 refs.)

117282 An in situ slow extension rate fracture stage for Auger electron spectroscopy. G.S.Was, H.H.Tischner, J.R.Martin (Dept. of Nuclear Engng., Univ. of Michigan, Ann Arbor, MI, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1477-9 (1983).
A fracture stage is designed to permit slow strain-rate tensile fracture of metallic samples inside the Auger vacuum chamber. The fracture stage consists of two crossheads, one fixed and one moveable. A small electric motor drives the moveable crosshead to separate from the fixed crosshead at a constant rate down to 7×10^{-4} cm/s. Samples remain attached to the sample carousel stage during load and following fracture, they can be quickly translated and rotated into alignment with the Auger analyzer. Tests on hydrogen charged Inconel 600 result in fracture times of 2-3 min and fracture strains of 4%-6% yielding a fracture surface that is in excess of 75% intergranular. This technique is recommended for grain boundary analysis of ductile austenitic alloys. (6 refs.)

117283 A stable, pure inert gas source for discharge lamps. G.B.Hoflund (Dept. of Chem. Engng., Univ. of Florida, Gainesville, FL, USA), R.P.Merrill.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1560-2 (1983).
Discusses the use of the inert gas discharge lamp as a UV source for UPs. In particular a He flow system is described designed to give high purity He and stable operating pressures within the lamp. (3 refs.)

117284 Five-degrees-of-freedom stage for a scanning electron-beam microscope. G.Via (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.3A, p.1173-4 (Aug. 1983).
The objective of the stage is to enable the placement of a semiconductor wafer into a variety of orientations beneath the point of incidence of a scanning electron beam within a scanning electron-beam microscope chamber. (no refs.)

117285 Mobile detector for a scanning electron-beam microscope. G.Via (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.3A, p.1175-6 (Aug. 1983).
The structure of the detector-supporting mechanism is described. (no refs.)

117286 Fundamental theorem for type-1 magnetic contrast in the scanning electron microscope (SEM). O.C.Wells (IBM Thomas. J. Watson Res. Center, Yorktown Heights, NY, USA).
J. Microsc. (GB), vol.131, pt.3, p.RP5-6 (Sept. 1983).
The fringing field from a sample such as cobalt can be studied in the secondary electron (SE) image in the SEM by means of type-1 magnetic contrast, in which broad bands of bright or dark contrast are centered on the domain walls. This is because the SE are deflected by the fringing from the specimen. (6 refs.)

117287 A chemical thinning technique for transmission electron microscopy cross-sectional samples. R.J.Gaboriaud (California Inst. of Technol., Pasadena, CA, USA).
J. Electron. Mater. (USA), vol.12, no.5, p.837-44 (Sept. 1983).
An essentially chemical thinning method for cross-sectional electron microscopy samples is described. This method can give cross-sectional samples in less than three hours without ion milling. This technique has been applied to a silicon wafer that had been amorphized by ion implantation and then partially annealed. An amorphous silicon layer as thin as 200 Å was observed. (6 refs.)

117288 Using a microprocessor to analyse particle shape—a tutorial system. D.Fay (Computer Sci. Dept., Queen's Univ. of Belfast, Belfast, N Ireland).
Microprocess. & Microsyst. (GB), vol.7, no.7, p.300-5 (Sept. 1983).
Scientists of various disciplines are interested in particle morphology. The author describes some of the design decisions for a system using a low cost microprocessor and its associated equipment. The microprocessor (Apple II) collects images using a single-board TV scanner (Microworks Digisector) connected to an inexpensive security camera or to a scanning electron microscope. Interactive output is obtained from one TV monitor connected to the scanner and another connected to the microcomputer. A graph plotter (Hewlett-Packard 7225A) is used for hard-copy output. The programs are all written in UCSD PASCAL except for four short assembly language routines used for interfacing the TV scanner. The system is intended for tutorial purposes in computer science courses in addition to its prime application function. (4 refs.)

117289 Secondary electron and ion imaging in scanning ion microscopy. R.Levi-Setti (Enrico Fermi Inst. & Univ. of Chicago, Chicago, IL, USA).
Scanning Electron Microsc. (USA), pt.1, p.1-22 (1983). (Scanning Electron Microscopy 1983 Conference, Dearborn, MI, USA, 17-22 April 1983).
Ion beams extracted from liquid metal ion (LMI) sources can presently be focused to spot sizes 50-100 nm wide at currents of 10-100 pA-adequate to perform, among others, imaging functions in the scanning ion microscope (SIM). Good quality micrographs of conductors and insulators can be obtained using either the ion-induced secondary electron signal (ISE) or the secondary ion signal (ISI), at useful magnifications in the 200-4000 range. The large depth of field of the SIM ($\sim$1 mm) yields detailed ISE and ISI images of surface topography of three-dimensional objects. Evidence of pronounced Z-contrast effects have been obtained. Large crystallographic contrast, dependent on beam-target orientation, has been obtained. Large crystallographic contrast, dependent on beam-target orientation, has been observed in metals and semiconductors. This is attributed to the modulation of ISE and ISI emission by primary ion channelling effects. (67 refs.)

117290 Reproducibility of electron spectroscopy data with different analyzers. C.Le Gressus, O.Lee-Deacon (CENS, Gif-sur-Yvette, France), K.Yates, R.West.
Scanning Electron Microsc. (USA), pt.1, p.77-84 (1983). (Scanning Electron Microscopy 1983 Conference, Dearborn, MI, USA, 17-22 April 1983).
One of the important issues in electron spectroscopy is the reproducibility of data with different spectrometers. Differences in sample preparation, vacuum systems, and energy analyzers can lead to a dispersion in results. The authors compare the AES, ELS, and SES of clean aluminum samples obtained with two kinds of analyzer (CMA and HMA) and in different kinds of vacuum system. These spectra agree well with each other qualitatively; but quantitative discrepancies exist. The authors point out certain parameters to be included in the theories for quantitative data normalization in electron spectroscopy. (10 refs.)

117291 On the optimal parameters of a cylindrical mirror analyzer. Q.Wang, K.Lu, Z.Y.Hua (Modern Phys. Inst., Fudan Univ., Shanghai, China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.235-44
The influence of parameters on the angular aberration of a cylindrical mirror analyzer (CMA) used for electron spectrometers was digitally analyzed. It was found that the conventionally used parameters which satisfied the second-order focusing condition are not really optimized. A new method using the 'S-type aberration characteristics (SAC)' of the CMA has been proposed for minimizing the angular aberration. The optimal operation parameters were derived by numerical methods for various cases. Theoretical results showed that for a typical case the angular aberration corresponding to the optimal parameters obtained by the SAC method is only 25% of that obtained by the second-order focusing method. Since there is no limitation caused by the condition of the second-order focusing, the design of a CMA using the SAC method might have a much greater flexibility. (7 refs.)

Scanning Electron Microscopy 1983 Conference ....See Entry 116926

Quantitative serial sectioning analysis: preview ....See Entry 117228

Distribution-free estimation of sphere size distributions from slabs showing overprotection and truncation, with a review of previous methods ....
....See Entry 117229

High resolution scanning secondary ion mass spectrometry (SIMS) using liquid metal field-ionization sources ....See Entry 117275

On the identification of numerical simulation of contrasts visible in crystalline interfaces ....See Entry 118828

Grain boundaries structure observed by high resolution electron microscopy .....
....See Entry 119027

Intergranular segregation phenomena studied by AES ....See Entry 120194

Secondary ion mass spectroscopy applications in semiconductor technology: III-V compound and other material structures ....See Entry 120213

A combined instrument for the investigation of catalytic reactions by means of gas chromatography, secondary ion and gas phase mass spectrometry, Auger and photoelectron spectroscopy, and ion scattering spectroscopy ....
....See Entry 120672

The use of a versatile specimen holder to prepare cultured cells for scanning electron microscopy ....See Entry 121082

07.85 X-RAY, GAMMA-RAY INSTRUMENTS AND TECHNIQUES

117292 Automation of the control of two physical experiments by M 7000 computer. P.Demel, J.Fafl, J.Mayrhoferova, J.Nadrchal, O.Smotlacha (Fyzikalni Ustav CSAV, Praha, Czechoslovakia).
Cesk. Cas. Fyz. Sekce A (Czechoslovakia), vol.33, no.4, p.373-9 (1983). In Czech.
Describes the implementation of automatic control of two devices: a spectrometer EXAFS and magnetic anisometer. The results are evaluated. (2 refs.)

117293 Crystals for synchrotron radiation experiments. J.Hrdy, E.Krousky, J.Traugott (Fyzikalni Ustav CSAV, Praha, Czechoslovakia), A.Zborilek, D.Mrazek, Z.Danicek.
Cesk. Cas. Fyz. Sekce A (Czechoslovakia), vol.33, no.4, p.380-2 (1983). In Czech.
The fabrication of silicon single crystals for a broad wavelength range X-ray spectrometer and monochromator suitable for synchrotron radiation experiments is described. (2 refs.)

117294 Flash X-ray cinematography at framing rates up to 4.10^7 images/sec: application to terminal ballistics. F.Jamet, F.Hatterer (Inst. Franco-Allemand de Recherches de Saint-Louis, Saint-Louis, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.164-7 (1983). (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
Presents a novel tube including four flash X-ray sources equally spaced by 20 mm only so that parallax can be neglected in most cases. The electrodes consist of four cathodes and a single anode on which deflectors are mounted in order to prevent the vapors produced in a discharge space from attaining the other discharge spaces. The shortest time interval separating two successive discharges is only limited by the X-ray pulse duration, i.e. 25 ns. The novel flash X-ray tube is used in connection with four 500 kV, 60 J, Marx-surge generators. A dose of 1.94 μC/kg per pulse at 1 meter from the anode is reached. The frame recording method uses a fluorescent screen converting X-rays in light photons and a high speed electronic camera ('Imacon 790'). This new flash X-ray cinematographic device has been used for recording phenomena in terminal ballistics. Examples are given of frames showing the penetration of projectiles into a target. (3 refs.)

117295 Tomographic reconstruction from a limited number of projections. J.J.Lefebvre, J.Marilleau, T.Rousseau, P.Tremelat (CEA, Centre d'Etudes de Vaujours, Sevran, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.195-203 (1983). (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
Studies the 3D reconstruction of simple objects from transmitted radiographs on the basis of computed tomography. A limited number of projections (about ten) is considered and a comparison given for different algorithms (convolution and algebraic reconstruction technique—ART). Results are presented for computed and experimental well known objects. (7 refs.)

117296 Processing system for radiographic pictures. P.Tremelat, J.J.Lefebvre, J.P.Aubry, P.Boutillier (CEA, Centre d'Etudes de Vaujours, Sevran, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.204-7 (1983). (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
Radiographies of moving objects are affected by typical artefacts. The problems encountered in interpreting such pictures are described. Numerical and computing tools provided in order to solve these problems are presented. (2 refs.)

117297 Soft X-ray imaging microscopy using zone plates and nonsynchrotron sources. R.J.Rosser (Blackett Lab., Imperial Coll. London, London, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.711-15 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Considers the resolution of hydrated biological specimens by soft X-ray microscopy. This is set by damage to the specimen caused by secondary electrons and free radicals. Using synchrotron radiation the limit would be about 10 nm. By using short lived ($\sim$ 1 ns) sources as produced by a laser generated plasma, the Rayleigh limit of 2.3 nm should be possible. (11 refs.)

117298 Monolithic double-grooved-crystal monochromators with tunable harmonic suppression for neutrons and X-rays. U.Bonse, K.Olthoff-Munter, A.Rumpf (Inst. fur Phys., Univ. of Dortmund, Dortmund, Germany).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.524-31 (1 Oct. 1983).
The principal methods of employing double-crystal reflection for harmonic rejection are briefly reviewed. The effect of using nonequal d spacings (dispersion) is considered. A new type of perfect-crystal monochromator consisting of a monolithic combination of a pair of grooved crystals a and b is described. The monochromaticity (degree of harmonic suppression) $M(\beta)$ is tuned by tilting groove a with respect to groove b by an appropriate angle β. The tilting is achieved in a simple way through a pair of helical springs. With three reflections in the first and two reflections in the second groove $M(\beta_0)$ values between 300 and 100 have been measured for X-rays at energies ranging from 6.72 to 9.86 keV and at a bandwidth $\Delta E/E \simeq 1.5\%$. β_0 is the tilting angle for which $M(\beta)$ is optimized. Once aligned the monochromator is a very simple unit, which can be mounted on any standard goniometer head and which can be used for both X-rays and thermal neutrons. (10 refs.)

117299 A focusing Weissenberg camera with multi-layer-line screens for macromolecular crystallography. N.Sakabe (Dept of Chem., Nagoya Univ., Nagoya, Japan).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.542-7 (1 Oct. 1983).
A conventional Weissenberg camera (Weissenberg 1924) has been modified for macromolecular crystallography. This camera system consists of a doubly bent LiF monochromator, a newly designed Weissenberg goniometer with multi-layer-line screens and its controller. The camera is useful for recording many reflections up to high resolution on a film with high signal-to-background ratio from a crystal with large unit-cell dimensions without losing any of the diffracted beams by screens. The resulting photograph is very easy to index, and the ratio of partially recorded reflections to fully recorded reflections decreases in comparison with an oscillation camera. The multi-layer-line screens are especially practical with a continuous X-ray beam such as synchrotron radiation where both wavelength and band pass can be selected properly. The preparation of a point-focusing monochromator from a single crystal of LiF is described, and the recording of anomalous dispersion profiles is discussed. (5 refs.)

117300 A small-angle camera for resonant scattering experiments at the storage ring DORIS. H.B.Stuhrmann (Inst. fur Phys. Chem., Univ. Mainz, Mainz, Germany), A.Gabriel.
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.563-71 (1 Oct. 1983).
Resonant small-angle scattering is measured routinely in the wavelength range of 0.6 to 3.25 Å with the instrument X15 at the storage ring DORIS. The monochromatic beam with a vertical offset of 1.22 m is achieved by a double monochromator system with a constant exit slit. The small-angle instrument allows sample-detector distances between 0.37 and 7.33 m. A multiwire proportional counter with a sensitive area of 200×200 mm detects the scattered intensity with a spatial resolution of 2×2 mm. Its sensitivity can be adapted to the requirements of the experiment by activating a drift chamber of 8 cm depth at the back end of the detector. The performance of the instrument as a function of the wavelength is described. The energy resolution is about 1 eV at the L_3 absorption edge of caesium, as shown by the resonant scattering of ferritin in 30% CsCl solution. (23 refs.)

117301 A remote-control direct-beam exposure device for the Arndt-Wonacott rotation camera. J.R.Helliwell (Dept. of Phys., Univ. of Keele, Keele, England), A.W.Thompson.
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.579 (1 Oct. 1983).
The authors report a simple modification to the standard Enraf-Nonius backstop for the reproducible movement of the backstop 'out' and 'back into' the beam by remote control. The time spent out of the beam is variable and the total movement such that a small piece of metal foil adjacent to the backstop attenuates the direct beam in the 'out' position and lies in the pattern 'blind region' when the backstop has been returned to trap the beam. (no refs.)

117302 Measurements of EXAFS in a laboratory. K.Tohji, Y.Udagawa (Inst. for Molecular Sci., Myodaiji, Okazaki, Japan).
J. Spectrosc. Soc. Jpn. (Japan), vol.32, no.4, p.255-62 (1983). In Japanese. (21 refs.)

117303 Evaluating radiographic systems using the resolving power function. A.Notea (Dept. of Nuclear Engng., Technion-Israel Inst. of Technol., Haifa, Israel).
NDT Int. (GB), vol.16, no.5, p.263-70 (Oct. 1983).
The various definitions in common use for quantitative characterization of radiographic systems can each be derived from a more general approach involving the resolving power function. Image contrast reduction, minimum detectable change, spatial resolution and the modulation transfer function are analysed, using mainly experimental data obtained with a flash X-ray unit. Dependence on the shape of the line spread function is demonstrated by using exponential and rectangular distribution functions, and the need for a detailed knowledge of the line spread function is stressed. The modelling presented is a useful tool for predicting the limitations of a given system and for optimizing design and working procedures. (13 refs.)

117304 A miniature high-frequency X-ray radiator with a shoot-through anode. A.D.Grigor'ev, S.A.Ivanov, G.N.Platonov, N.N.Potrakhov.
Radioelectron. & Commun. Syst. (USA), vol.25, no.7, p.95-7 (1982). Translation of: *Izv. VUZ Radioelektron. (USSR)*, vol.25, no.7, p.85-7 (1982). [received: Oct. 1983]
Considers a miniature X-ray radiator with a shoot-through type target. The radiator has a glass-metal envelope consisting of the body of cylindrical shape and a glass mounting, connected hermetically to one another. The focusing electrode and the cathode with the heater are mounted on a glass mounting. Inside the mounting there is a helical slow-wave system, which forms a quarter-wave resonator with the body of the radiator. The shoot-through anode with a thin film rhenium target is soldered to the end of the radiator. (4 refs.)

117305 X-ray fluorescence analysis using the Chem-X low power wavelength dispersive spectrometer. Y.M.Gurvich (Bausch & Lomb, Sunland, CA, USA).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.449-59
The Chem-X is an instrument combining reasonable wavelength coverage with sufficient sensitivity and speed for production control analysis—at an affordable price. It is capable of determining up to eight elements ($Z \geq 13$) simultaneously. Plug-in type monochromators can be easily exchanged by the operator; thus it is possible to keep on the shelf a 'library' of monochromators for different analytical programs. Flat crystals can be rapidly aligned to an analytical line simply by turning a single handle. The X-ray tube used in the Chem-X can be operated at up to 50 kV or 5 mA, maximum power 200 W. The cassette version of the SAS-11 software package, together with the DEC SB-11 microcomputer, allows for considerable flexibility, including major matrix correction algorithms normally available in larger X-ray systems. (2 refs.)

Cryostat for testing luminescence and radiation absorption in ionic crystals .... See Entry 117185

Autoradiography: a review of basic principles .... See Entry 117259

An absolute intensity standard for small-angle X-ray scattering measured with position-sensitive detectors .... See Entry 118809

A computer X-ray quantitative phase analysis .... See Entry 118810

Eccentricity corrections for a modified Debye-Scherrer camera .... See Entry 118813

Detector aperture size in the conventional estimation of integrated intensity in the $\omega/2\theta$ scan mode .... See Entry 118814

A simplified sample cooling system for X-ray diffraction experiments .... See Entry 118817

Signal-to-noise ratio at the output of a flaw detector with a mosaic semiconductor hard X-ray detector and digital signal processing .... See Entry 120555

Automating radiometric monitoring .... See Entry 120575

Optimizing X-raying of steel items .... See Entry 120576

Use of FT-41 phototechnical film in X-ray examination .... See Entry 120577

Numerical method of 'adapted' deconvolution: application to the tomography by coded aperture .... See Entry 120994

Study of methods of 3-D reconstruction in radiography .... See Entry 120997

High-speed cineradiographic system for biomechanics impact research .... See Entry 121062

γ-ray spectrometric determination of uranium-series nuclides in marine phosphorites .... See Entry 121379

07.90 OTHER TOPICS IN SPECIALISED INSTRUMENTATION

117306 A variable-temperature sample container for low-temperature neutron powder diffraction. E.Arzi (Dept. of Phys., Univ. of Tehran, Tehran, Iran), E.Sandor.
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.449-52 (1 Oct. 1983).
A variable-temperature sample container was developed for the neutron powder diffraction study of crystal structures and phase transitions in solidified gases. It consists of two coaxial tubes made of boron-free fused silica and fitted with heating coils and thermocouples. The exchange space between the tubes is filled with low-pressure helium gas controlled by two fine needle valves. Used in conjunction with a centre-stick-type liquid-helium cryostat and a proportional temperature controller, it maintains a powder sample of about 8 cm^3 volume at a constant temperature anywhere in the 4.2 to 77.4K temperature range. Its stability is not worse than ±0.15K and the liquid helium consumption is about 1 litre a day above 17K, increasing up to 6 litres a day at lower temperatures. It can also be used for the preparation of fine-grained powder samples directly from the gas phase. (3 refs.)

117307 A method for analysing the rate of liquid evaporation. J.Trzeszczynski, T.Bojko, B.Lisiecka (Polytech. Szczecinska, Szczecin, Poland).
Pomiary Autom. Kontrola (Poland), vol.29, no.3, p.73-5 (March 1983). In Polish. [received: Sept. 1983]
Describes an apparatus for analysing evaporation rate of pure liquids and their mixtures under various conditions as to temperature, humidity, and air changes. Examples of investigation results, discussion of the dependence of liquid evaporation rate on air exchange and the ratio of the evaporation liquid area to the capacity of a model chamber given. The mathematical relationships presented permit the use of the results of model testing in real conditions. (7 refs.)

Monolithic double-grooved-crystal monochromators with tunable harmonic suppression for neutrons and X-rays .... See Entry 117298

A digitized telemetric system for transient phenomenon measurement [underwater explosion] .... See Entry 118697

A medium-resolution double-crystal diffractometer for the study of small-angle neutron scattering .... See Entry 118821

Measurements of angular evaporation characteristics of sources .... See Entry 120249

10.00 THE PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

(for cosmic rays, see 94.40; for high energy-experimental techniques and instrumentation, see 29.)

11.00 GENERAL THEORY OF FIELDS AND PARTICLES

(see also 03.65 Quantum mechanics, 03.70 Theory of quantized fields, 03.80 General theory of scattering)

11.10 FIELD THEORY

117308 Excited states of bosons and fermions in a four-Fermi quantum field theory. P.Furlan (Univ. di Trieste, Trieste, Italy), R.Raczka.
Ann. Phys. (USA), vol.149, no.2, p.296-334 (Sept. 1983).
A scalar-pseudoscalar four-Fermi quantum field model in four dimensional spacetime is considered. Introducing the scalar the pseudoscalar collective bosons, the path-integral representation for the generating functional for Green's functions in terms of the effective total action integral containing only collective bosons is expressed. Using a classical ground-state solution for collective bosons, a new formula for the generating functional for collective boson and fermion Green functions in terms of the effective propagators is derived. It is shown by a partly nonperturbative analysis that the excited

states of collective bosons do exist and form finite trajectories in the plane mass-square-spin. These trajectories for bosons are approximately linear in J, as the experimental trajectories. The existence of fermion bound or excited stars depend on the value of the dynamical parameters of the model. For some values of dynamical parameters there are bound states for $J={}^1/_2$ and ${}^3/_2$. However, for most of other values bound or excited fermion states do not exist. (19 refs.)

117309 Some remarks on the internal symmetries of relativistic wave equations. R.-K.Loide (Tallinn Polytech. Inst., Tallinn, USSR).
Acta Phys. Pol. B (Poland), vol.B14, no.9, p.671-8 (Sept. 1983).
The internal symmetries of relativistic wave equations in the free field case are treated. It is shown that the additional invariance of wave equations is connected with the transformations of physical basis. The dyal symmetry is shown to be the transformation of Lorentz basis. (20 refs.)

117310 Failure of the naive loop expansion for the effective potential in ϕ^4 field theory when there is 'broken symmetry'. C.M.Bender (Washington Univ., St. Louis, MO, USA), F.Cooper.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.3, p.4903-26 (19 Sept. 1983).
The authors determine the effective potential $V[\phi]$ in zero dimensional $g\phi^4$ field theory when there is broken symmetry classically $[V_{cl}={}^1/_4 g(\phi^2-a^2)^2]$ as a power series in $1/g$. They find that the usual loop expansion ignores a secondary minimum of the path integral and is only valid for $|\phi|\gtrsim a$. When $|ja|\lesssim 1$, where j is the external source, there is a secondary minimum of equal importance to the absolute minimum. In that region a kink solution to the differential equation for $\phi[j]$ exists, $\phi[j]=a\ \tanh(ja)+O(ja^2/ga^4)$, which interpolates between the minima at $\phi=-a$ and $\phi=+a$. They obtain the $1/g$ expansion for $V[\phi]$ for $\phi<a$ and $\phi\geq a$. For all g, a mean-field approximation gives an expression for $V[\phi]$ which interpolates between these two regimes. In higher dimensions the kink solution becomes $\phi[j]=a\ \tanh(ja\Omega)$, where Ω is the volume of space-time, suggesting a discontinuity in $\phi[j]$ in the infinite-volume limit. (15 refs.)

117311 Surface description of gauge theories. K.Bardakci (Dept. of Phys., Univ. of California, Berkeley, CA, USA), J.Greensite.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.3, p.451-68 (19 Sept. 1983).
The partition function of non-abelian gauge theory is expressed, in the continuum limit, as a sum over surfaces which are swept out by the propagation of electric flux rings. Each flux surface is described by a two-dimensional continuum gauge theory, confined to the particular surface. The gauge field can then be integrated out; however, for closed and intersecting surfaces interesting complications arise, which reveal an algebraic structure typical of strong-coupling lattice gauge theory. (7 refs.)

117312 Axial-vector anomaly for Dirac-Kahler fermions on the lattice. M.Gockeler (DESY, Hamburg, Germany).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.3, p.508-22 (19 Sept. 1983).
The axial-vector current of Dirac-Kahler fermions on the lattice is studied. The author considers a U(1) gauge theory in two dimensions as well as an SU(N) gauge theory in four dimensions. Using a short-distance expansion of the fermion propagator in an external gauge field, it is shown that the correct anomaly is reproduced in the continuum limit. (12 refs.)

117313 Topology and universality in the lattice CP^2 model. D.Petcher, M.Luscher (Inst. fur Theoretical Phys., Univ. Bern, Bern, Switzerland).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B225(FS9), no.1, p.53-76 (3 Oct. 1983).
The topological susceptibility χ_t and the correlation length ξ in the CP^2 model on a two-dimensional triangular lattice are calculated by the Monte Carlo simulation method. Using variant lattice actions, the authors verify the universality of the dimensionless quantity $\chi_t\xi^2\simeq 0.09$ in the scaling region, thus indicating the presence of physical topological effects in the scaling limit. As a by-product they obtain a combinatorial formula for the topological charge. (17 refs.)

117314 Analytic approximations to Hamiltonian lattice field theories. I. Periodic gaussian model for U(1) theories. P.Suranyi (Dept. of Phys., Univ. of Cincinnati, Cincinnati, OH, USA).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B225(FS9), no.1, p.77-92 (3 Oct. 1983).
Periodic gaussian models are introduced for local and global U(1) invariant hamiltonian lattice field theories. The models coincide with standard lattice theories at weak coupling but the leading non-perturbative contributions to wave functions and physical quantities are exactly calculable. Electric charges are confined and the mass gap is finite if correlations of an integer-valued magnetic field are of infinite range ($d=2+1$ gauge model). Otherwise, for {short-range correlations, the mass gap and the string tension vanish at weak coupling (QED, *XY* model, etc.). (11 refs.)

117315 Chiral symmetry restoration in baryon rich environments. J.Kogut, H.Matsuoka, M.Stone, H.W.Wyld (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA), S.Shenker, J.Shigemitsu, D.K.Sinclair.
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B225(FS9), no.1, p.93-102 (3 Oct. 1983).
Chiral symmetry restoration in an environment rich in baryon is studied by computer simulation methods in SU(2) and SU(3) gauge theories in the quenched approximation. The basic theory of symmetry restoration as a function of chemical potential is illustrated and the implementation of the ideas on a lattice is made explicit. A simple mean field model is presented to guide one's expectations. The second order conjugate-gradient iterative method and the pseudo-fermion Monte Carlo procedure are convergent methods of calculating the fermion propagator in an environment rich in baryon. Computer simulations of SU(3) gauge theory show an abrupt chiral symmetry restoring transition and the critical chemical potential and induced baryon density are estimated crudely. A smoother transition is observed for the color group SU(2). (8 refs.)

117316 Wilson loops for U(4) and SU(4) lattice gauge theories in four dimensions. D.Barkai (Inst. for Computational Studies, Colorado State Univ., Fort Collins, CO, USA), M.Creutz, K.J.M.Moriarty.
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B225(FS9), no.1, p.156-68 (3 Oct. 1983).
Monte Carlo simulations are used to calculate Wilson loops for pure U(4) and SU(4) gauge theories on a 6^4 lattice. The first-order phase transition previously observed in the average action per plaquette for U(4) and SU(4) is also seen in the string tension. U(4) and SU(4) color seem to be confined while U(1) charge in U(4) appears to be deconfined. (15 refs.)

117317 Instability of the mean field vacuum in lattice gauge theories. Guo Shuo-hong, Chen Qi-zhou, Liu Jin-ming, Ji Zhe-rui (Dept. of Phys., Zhongshan Univ., Guangzhou, China).
Commun. Theor. Phys. (China), vol.2, no.3, p.1115-19 (1983).
The authors calculate the interaction energy between a heavy quark pair in the Hamiltonian formulation of lattice gauge theories. Mean field-variational calculations show that the upper limit of the string tension is zero in the weak coupling region if an approximate vacuum state of the mean field type is used. The mean field vacuum is unstable against forming closed flux loops. (9 refs.)

117318 Simple α-parametric integrals for renormalised Feynman amplitudes. V.I.Kucheryavii.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.59-63 (1983). In Ukrainian.
Simple formulas are obtained for regular (finite) and singular parts of divergent Feynman amplitudes. These formulas are true for Feynman amplitudes of the smallest nontrivial orders of the perturbation theory irrespective of the kind of matrix elements and type of quantum field models with polynomial and quasi-polynomial interactions in n-dimensional space-time. (10 refs.)

117319 Elements for a Lie-isotopic gauge theory. M.Gasperini (Inst. di Fisica, Univ. degli Studi, Bologna, Italy).
Hadronic J. (USA), vol.6, no.4, p.935-44 (July 1983).
The author suggests the possibility of gauging a Lie-isotopic symmetry and, in analogy with conventional gauge theories, the author introduces the isotopic covariant derivatives and field strengths. The author shows that the requirement of local isotropic invariance is compatible with the introduction of a variable, effective, gauge coupling, and leads naturally to couple in a minimal way the gauge potential to the geometry of a curved manifold with an anti-symmetric connection. (32 refs.)

117320 Algebraic identities and invariant vector fields on H-spaces. A.A.Sagle (Inst. for Basic Res., Cambridge, MA, USA), J.P.Holmes.
Hadronic J. (USA), vol.6, no.4, p.945-55 (July 1983).
The authors study the equivalence of certain algebraic and geometric properties for analytic H-spaces utilizing vector fields. They define vector fields $l(x)$ and r(x) on an H-space which become the usual left and right vector fields in the case of a Lie group. Utilizing these vector fields, the local associativity, local power associativity and local alternative identities are characterized as invariance properties of these vector fields by suitable functions. These functions are in the semi-group G generated by the left and right multiplication functions (and their inverses, if they exist). They are considering the invariance of the vector fields under subsemi-groups generated by suitable functions in G. As a result of this, the Campbell-Hausdorff Theorem for H-spaces is related to alternative algebras and the invariance of the $l(x)$ and r(x) vector fields. All of these results are done in terms of differential equations. Thus, considering the recent use of nonassociative algebras in hadron physics, these results now give the physicist direct access to relevant identities. In particular, they discuss how this process applies to other identities and vector fields. (3 refs.)

117321 Causality between preparation and registration processes in relativistic quantum theory. H.Neumann (Fachbereich Phys., Philipps-Univ., Marburg, Germany), R.Werner.
Int. J. Theor. Phys. (USA), vol.22, no.9, p.781-802 (Sept. 1983).
A causality postulate is considered which is based on the conception of systems that are prepared in some finite region of space-time and recorded in some other region. If these regions are spacelike separated, the recording apparatus should react as if no preparing apparatus were present, i.e. it should respond with at most some vacuum rate. The causality postulate is mathematically formulated within the framework of statistical theories. The connections with algebraic field theory are discussed and the relation between causality and spectral conditions is studied. General methods for constructing systems satisfying the causality postulate are given and applied in several examples. (20 refs.)

117322 The scattering of two Yang-Mills plane waves. Y.Nutku (Dept. of Maths., Bosphorus Univ., Istanbul, Turkey).
J. Phys. A (GB), vol.16, no.15, p.L583-86 (21 Oct. 1983).
The author considers the head-on collision of two sandwich plane waves in nonAbelian gauge theory. A classical solution of the Yang-Mills field equations is obtained describing the scattering of weak plane waves. It is shown that after the collision the gauge field acquires a new inductive aspect due to the nonlinear interaction between these waves. (8 refs.)

117323 Phase transitions in nonlinear Abelian Higgs models. I.D.Lawrie, C.Athrone (Dept. of Phys., Univ. of Leeds, Leeds, England).
J. Phys. A (GB), vol.16, no.15, p.L587-90 (21 Oct. 1983).
Phase transitions in O(n) nonlinear σ models coupled to an Abelian gauge field are studied near two dimensions. For all $n>0$, the transition is governed by the renormalisation-group fixed point of the CP^{2n-1} model. There is no fluctuation-induced first-order transition. (12 refs.)

117324 The quantum fluctuations of (1+1)-dimensional real scalar fields around solitons at the finite temperatures. S.Chen, G.Ni (Dept. of Phys., Univ. of Illinois, Urbana-Champaign, IL, USA).
J. Phys. A (GB), vol.16, no.15, p.3493-506 (21 Oct. 1983).
The authors investigate the quantum fluctuations of real scalar fields in a $(1+1)$-dimensional space around the solitons at the finite temperatures, using a method based on the real-time Green function approach. They calculate the temperature dependence of the soliton masses in a sine-Gordon system and a ϕ^4 system respectively. They have taken into account the corrections due to the existence of bound states and the phase shifts for continuum states in soliton potentials. (16 refs.)

117325 Lorentz covariance of an extended object in the tree approximation. II. Nonspherical object in 3+1 dimensions. M.Umezawa (Univ. Louis Pasteur, Strasbourg, France).
J. Math. Phys. (USA), vol.24, no.9, p.2348-65 (Sept. 1983).
For pt.I see Phys. Rev. D, vol.24, p.1548 (1981). This is the second in the series of the papers in which the author investigates the Lorentz covariance of the extended object. In this paper the author examines the covariance of the deformed object in $3+1$ dimensions in the tree approximation. The author constructs the solution of the Euler equation which is Lorentz covariant. In such a covariant solution, the variables associated with the rotational and the translational zero modes appear as classical quantum mechanical operators. Consequently the covariant solution has an intrinsic spin in addition to the intrinsic quantum mechanical momenta. Then, at the end of this work the author will show that such a covariant solution can be obtained also by quantizing a classical solution of the Euler equation, having extra variables signifying the center and the orientation of the deformed object. In the tree approximation, the energy-momentum and the relativistic angular momentum of the extended object ψ become pure classical quantum mechanical operators, having been integrated over the space. Then it is proven that such four-momenta and angular momentum operators form a classical quantum

mechanics presented in a relativistic manner. The center of mass of the extended object, often called collective coordinate, is shown to be made of these four-momentum and angular momentum. This center of mass and the four-momentum operators form a quantum mechanics presented in the conventional form. (24 refs.)

117326 An SL(2,*C*)-invariant representation of the Dirac equation. II. Coulomb Green's function. L.C.Hostler (Phys. Dept., Wilkes Coll., Wilkes-Barre, PA, USA).
J. Math. Phys. (USA), vol.24, no.9, p.2366-73 (Sept. 1983).
For pt.I see ibid., vol.23, p.1179 (1982). The Kepler problem for the Klein-Gordon type wave equation $\{\Pi_\mu \Pi_\mu + m^2 + ie\sigma.(\mathcal{E}+i\mathbf{B})\}\phi=0$, investigated earlier (J. Math. Phys. 23, 1179, 1982) and proven to be equivalent to the conventional Dirac equation, is discussed. In this equation ϕ is a 2×1 Pauli spinor and σ_a, $a=1,2,3$, are the usual 2×2 Pauli spin matrices. Quite simple expressions for the bound state Coulomb wavefunctions and for the Coulomb Green's function are obtained by exploiting the concept of 'coupling constant eigenfunction'. The facilitate the direct use of these simple expressions in Coulomb calculations, a stationary state perturbation theory appropriate for the Klein-Gordon type wave equation itself is described. (19 refs.)

117327 Infinitesimal symmetries and conserved currents for nonlinear Dirac equations. P.H.M.Kersten (Dept. of Appl. Math., Twente Univ. of Technol., Enschede, Netherlands).
J. Math. Phys. (USA), vol.24, no.9, p.2374-6 (Sept. 1983).
The complete algebras of infinitesimal symmetries for Dirac equations, Dirac equations with nonvanishing rest mass, and Dirac equations with a nonlinear term have been established. In addition, conserved currents associated to new symmetries have been constructed. (10 refs.)

117328 U(*N*) and SU(*N*) lattice gauge theories, in the weak-coupling region, in four dimensions. M.Creutz (Dept. of Phys., Brookhaven Nat. Lab., Upton, NY, USA), K.J.M.Moriarty.
J. Phys. G (GB), vol.9, no.10, p.L207-10 (Oct. 1983).
Monte-Carlo simulations on a 6^4 lattice are employed to calculate the 1×1 Wilson loops $W(1, 1)$ and the associated string tension for pure U(N) and SU(N), N=2, 3, 4, 5 and 6, gauge theories in the weak-coupling region. It is shown that $\mathrm{U}(N) \to \mathrm{SU}(N)$ as N increases, with $\mathrm{U}(6) \simeq \mathrm{SU}(6)$. (9 refs.)

117329 On the relationship between Abelian and SU_2 *n*-monopoles. M.Quiros (Inst. de Estructura de la Materia, Madrid, Spain), E.Rodriguez.
Nuovo Cimento A (Italy), vol.76A, ser.2, no.3, p.495-508 (1 Aug. 1983).
Using the embedding of the Hopf bundle into the trivial bundle $S^2 \times S^3$, the authors obtain the Dirac-Wu-Yang regular vector potential on S^3 from the 't Hooft-Polyakov monopole field. Furthermore, it is shown that the electromagnetism bundle S^3/Z_n is a U_1 reduced bundle of $S^2 \times S^3$. From this bundle reduction and the connection one-form on S^3/Z_n they get the asymptotic behaviour of the SU_2 n-monopole field. Axial symmetry, usually assumed for BPS monopoles is obtained and the asymptotic behaviour of n-monopole solutions of the Ernst equation is predicted. (27 refs.)

117330 The stringless gague potential of accelerated monopole. Kang-Jie Shi (Univ. of Illinois, Urbana-Champaign, IL, USA), Yu-Bin Wang, Bo-Yu Hou.
Nuovo Cimento A (Italy), vol.76A, ser.2, no.3, p.556-68 (1 Aug. 1983).
The authors get the U_1 potential without singular string for an accelerated magnetic pole. To obtain this they find its equivalent SU_2 potential, which could be expressed by an U_1-invariant section of the SU_2/U_1 coset bundle. Then they could superpose linearly the corresponding U_1 potentials to get the potential of an accelerated system of monopoles and electric charges in the general case. They also discuss the criterion for U_1 field to be in one-to-one correspondence with an U_1-invariant section and the condition for a SU_2 field to be reducible to an U_1 field. (8 refs.)

117331 On Dirac-like equations in 2*n*-dimensional spaces. II. P.Budinich, P.Furlan (Internat. School for Advanced Studies, Trieste, Italy).
Nuovo Cimento A (Italy), vol.76A, ser.2, no.3, p.569-95 (1 Aug. 1983).
For pt. I see ibid., vol.70, no.3, p.243-72 (1982). The naturally $IO_{4,2}$ covariant spinor field equations $\Gamma_a(\partial/\partial\eta_a)\xi(\eta)=0$ and $\Gamma_a(\partial/\partial\eta_a)\xi(\eta)=\Gamma_7\phi(\eta)\xi(\eta)$ in pseudo-Euclidean space $M^{4,2}$, of which the first may be derived from the definition of pure conformal semi-spinors and the second from the one of pure conformal spinors are first reduced, with the Dirac method, to a five-dimensional projective space and then solved exactly with respect to the fifth variable, which is then eliminated with an invariant procedure, bringing them to a system of equations in Minkowski space-time $M^{3,1}$. The first of the two equations presents solutions which are apt to reproduce the main features of weak interactions. (7 refs.)

117332 One-dimensional exactly integrable dynamical systems (classical and quantum regions). I.A.Fedoseev, A.N.Leznov (IHEP, Serpukhov, USSR), M.V.Saveliev.
Nuovo Cimento A (Italy), vol.76A, ser.2, no.3, p.596-612 (1 Aug. 1983).
The authors develop an approach for the construction of explicit solutions to a wide class of essentially nonlinear exactly integrable one-dimensional systems in classical and quantum regions. The systems describe, in particular, monopole configurations for an arbitrary embedding of SU_2 in a gauge group with a Higgs field in the adjoint representation and with vanishing self-coupling. The approach is based on the application of the usual perturbation theory methods in the framework of the Yang-Feldman formalism and gives an exact solution of the classical equations and the Heisenberg operators in the quantum case as finite polynomials over a coupling constant. An investigation of the systems in the Schrodinger picture is also given. In this, the wave functions are expressed directly via the matrix elements of the principal continuous series of the unitary irreducible representations of the real forms of the semisimple Lie groups between the states, which are the generalized Whittaker vectors. (14 refs.)

117333 Self-dual SU$_2$ Yang-Mills fields in Minkowski space. E.Kyriakopoulos (Phys. Lab. A, Nat. Tech. Univ., Athens, Greece).
Nuovo Cimento A (Italy), vol.76A, ser.2, no.4, p.645-62 (21 Aug. 1983).
It is shown that all self-dual SU$_2$ Yang-Mills fields in Minkowski space can be obtained from the solutions of a system of nonlinear partial differential equations of second order and some arbitrary functions. Certain features of these fields are pointed out. The complex field, whose real part is the De Alfaro-Fubini-Furlan solution (1977) is presented as solution of the nonlinear system. (11 refs.)

117334 The classical supersymmetric CP^{N-1} model. M.Schweda, J.Weigl (Inst. fur Thoretische Phys., Tech. Univ. Wien, Wien, Austria).
Nuovo Cimento A (Italy), vol.76A, ser.2, no.4, p.715-22 (21 Aug. 1983).
At the classical level the model under consideration contains a spinorial gauge superfield A_a, which is not a dynamical field variable. The authors discuss some aspects of the superconformal supersymmetry in the presence of this gauge field by explicit calculation. Their results are governed by gauge invariance and the equation of motion for the A_a-field. (5 refs.)

117335 Elementary particle as a localized excitation of the action function. G.I.Sivashinsky (Dept. of Math., Univ. of California, Berkeley, CA, USA).
Nuovo Cimento A (Italy), vol.77A, ser.2, no.1, p.21-38 (1 Sept. 1983).
By developing the analogy between the equation for the propagation of a flame and the Hamilton-Jacobi equation of relativistic mechanics, one constructs a modified Hamiltonian-Jacobi equation: $(1/c^2)S_t{}^2-(\nabla S)^2=m^2c^2+\alpha\hbar\Box S+(\beta\hbar^3/m^2c^2)\Box^2 S$. This equation admits solutions in the form of oscillating solitons. The possible connection between this kind of solutions and quantum mechanics is discussed. (9 refs.)

117336 Aspects of gauge variance and geometry in a fermionic *-product formalism. B.Lesche (Max-Planck-Inst. fur Phys. und Astrophys., Munich, Germany).
Nuovo Cimento A (Italy), vol.77A, ser.2, no.2, p.121-34 (21 Sept. 1983).
The author gives a phase-space formulation for quantized fermion fields and discusses geometric and gauge properties in this framework. (14 refs.)

117337 Infra-red behaviour of the gluon propagator in axial gauges. D.Atkinson (Inst. for Theoretical Phys., Groningen, Netherlands), P.W.Johnson, W.J.Schoenmaker, H.A.Slim.
Nuovo Cimento A (Italy), vol.77A, ser.2, no.2, p.197-213 (21 Sept. 1983).
Closed systems of approximate Dyson-Schwinger equations for the gluon propagator are investigated, in which the simplest Slavnov-Taylor identity is respected. It is rendered plausible that the model of Baker, Ball and Zachariasen (1981), which does yield a confining singularity, cannot consistently dispense with the dependence on the gauge parameter. A spectral model of Delbourgo (1979, 1981) is shown to violate the Slavnov-Taylor identity in an unacceptable manner. An improved spectral model is introduced. (12 refs.)

117338 Quasi-local charges in Yang-Mills theory. K.P.Tod (Math. Inst., Univ. of Oxford, Oxford, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1797, p.369-77 (8 Oct. 1983).
A definition of quasi-local charges in Yang-Mills theory, in the spirit of Penrose's quasi-local momentum in general relativity (1982), is proposed. (12 refs.)

117339 The energy-momentum operator in curved space-time. M.R.Brown, A.C.Ottewill (Dept. of Astrophys., Univ. of Oxford, Oxford, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1797, p.379-403 (8 Oct. 1983).
The authors argue that the only meaningful geometrical measure of the energy-momentum of states of matter described by a free quantum field theory in a general curved space-time is that provided by a normal ordered energy-momentum operator. They contrast the finite expectation values of this operator with the conventional renormalized expectation values and further argue that the use of renormalization theory is inappropriate in this context. (30 refs.)

117340 Variational study of vacuum wave function for lattice gauge theory in 2+1 dimension. H.Arisue, M.Kato, T.Fujiwara (Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.229-48 (July 1983).
The vacuum wave function for SU(2) lattice gauge theory (without quarks) in 2+1 dimensions (two discrete space and one continuous time) is studied using the Rayleigh-Ritz variational method. Trial wave function for the vacuum contains loop variables enclosing up to two plaquettes, whose coefficients are taken as variational parameters. It is found that the coefficients of two-plaquette loop variables are small compared with that of one-plaquette loop variables not only in the strong-coupling regime but also in the weak coupling region. This fact means that the dominant configuration of the vacuum is mutually independent magnetic fluctuations in each plaquette and enables the authors to perform a perturbative expansion with respect to these small coefficients. The string tension and the wave function of the first excited state are investigated using the vacuum wave function obtained, and the scaling behaviours of the string tension and the mass gap are much improved by the introduction of two-plaquette loop variables compared with the case of the vacuum wave function containing only one-plaquette loop variables. (16 refs.)

117341 Supersymmetry and scale-dependent analysis. M.Ikeda (Dept. of Phys., Osaka City Univ., Osaka, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.249-58 (July 1983).
It is argued that scale-dependent analysis shows a restoration of supersymmetry although temperature dependent analysis does not indicate such a restoration of supersymmetry (if initially broken). The author demonstrates this explicitly in the two-dimensional O(N) Wess-Zumino model that has both supersymmetric and broken-supersymmetric phases. In the broken-supersymmetric phase, there is a critical resolution $\mathrm{R_c}$ that is renormalization group invariant. The vacuum undergoes a phase transition in resolution R; for $\mathrm{R}<\mathrm{R_c}$ the vacuum is in a disordered phase while for $\mathrm{R}>\mathrm{R_c}$ it is in an ordered phase. The resolution-dependent analysis is also applicable to supersymmetric theories as well as to QCD and GUT. (14 refs.)

117342 Effective gauge interaction of Weyl fermions: extended-MAC scenario. K.-I.Aoki, M.Bando (Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.259-71 (July 1983).
Effective gauge interaction of massless Weyl fermions is investigated for the $\mathrm{j}={}^1/_2$-state sector. In addition to the familiar λ-λ term there arises $\lambda\sigma$-$\lambda\sigma$ term which leads a strong dependence of the interaction energy of a trial state on its spin and chiral structure. With this Hamiltonian the authors perform the extended-MAC (EMAC) scenario. They analyze two fermion systems and show that LR state is more attractive than LL state. The EMAC scenario enables investigation of the structure of various multifermion condensations, which will be explicitly done in a separate article. (4 refs.)

117343 Hierarchical multi-fermion condensation in extended-MAC scenario. K.-I.Aoki, M.Bando (Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.272-83 (July 1983).
By the use of the effective gauge interaction of massless Weyl fermions derived in a preceding article, the authors perform the extended-MAC (EMAC) scenario to analyze multifermion systems. They show that a 2-n-body multifermion state $(\mathrm{LR})^n$ becomes more attractive as n increases. They conclude that in a confining gauge theory multifermion operators can develop vacuum expectation values of various scales. This mechanism of hierarchy in condensations provides a possible origin of the fermion mass hierarchy among generations in sublepton/quark models. (6 refs.)

117344 Quantum theory of massive Yang-Mills fields. III. Renormalizable structure. T.Fukuda, H.Matsuda, Y.Seki, K.Yokoyama (Res. Inst. for Theoretical Phys. Hiroshima Univ. Hiroshima Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.284-97 (July 1983).
For pt.II see ibid., vol.67, p.1206 (1982). The renormalizable structure of a massive Yang-Mills field theory proposed previously is revealed in view of nonpolynomial Langrangian theories. Analytic properties of several relevant superpropagators are elucidated in the sense of distributions. It is shown that these regularized superpropagators exhibit a strong infinity-suppression

mechanism making the theory renormalizable. There appears a divergence-free model as a subcase of the present theory. (18 refs.)

117345 Equivalence of stochastic quantization method to conventional field theories through super transformation invariance. H.Nakazato, M.Namiki, I.Ohba, K.Okano (Dept. of Phys., Waseda Univ., Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.298-307 (July 1983).
The equivalence of the stochastic quantization method to the usual quantization method is proved to all orders in perturbation for scalar field theories. The proof is based on invariance under a sort of 'super transformation'. (8 refs.)

117346 Gauge fixing condition as non-holonomic constraint in stochastic quantization of non-abelian gauge fields. H.Nakogoshi, M.Namiki, I.Ohba, K.Okano (Dept. of Phys., Waseda Univ., Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.326-9 (July 1983).
In stochastic quantization of non-Abelian gauge fields, the authors introduce a sort of non-holonomic constraint working as a covariant gauge fixing condition in the Langevin equation, and show that the new condition kills fictitious time-dependent divergent terms keeping the gauge invariance and the unitarity without help of any ghost field. The procedure also suggests a possible way of quantizing non-holonomic systems. (6 refs.)

117347 Boundary conditions on the monopole Dirac equation. C.G.Callan,Jr. (Inst. for Advanced Study, Princeton, NJ, USA), S.R.Das.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1155-8 (26 Sept. 1983).
Boundary conditions on the monopole Dirac equation are, on the one hand, determined by the requirement that the Hamiltonian be Hermitean. On the other, they enforce the conservation of certain charges at the monopole core. Which charges should be conserved is determined by the short-distance physics of the problem and the connection with boundary conditions is worked out for several cases. It is found to be possible to impose physically reasonable conservation-law requirements which can be realized by no Dirac-equation boundary condition. (5 refs.)

117348 A superfield formulation of stochastic quantization with fictitious time. E.Egorian (Theoretical Phys. Dept., Erevan Inst. of Phys., Erevan, USSR), S.Kalitzin.
Phys. Lett. B (Netherlands), vol.129B, no.5, p.320-2 (29 Sept. 1983).
Proves the equivalence between the D-dimensional scalar quantum field theory and the corresponding $D+1$ (with fictitious time) stochastically quantized field theory. The superdiagram technique is used within perturbation theory. The independence of the Green's functions on the fictitious time is shown. (4 refs.)

117349 The latent heat of deconfinement in SU(3) Yang-Mills theory. T.Celik, J.Engels, H.Satz (Fakultat fur Phys., Univ. Bielefeld, Bielefeld, Germany).
Phys. Lett. B (Netherlands), vol.129B, no.5, p.323-7 (29 Sept. 1983).
Calculates the latent heat of deconfinement in SU(3) Yang-Mills theory from the difference in energy density between the deconfined and the confined phases at the critical temperature T_c. The calculation is based on a high statistics Monte Carlo evaluation using lattices with 8^3 and 10^3 spatial sites and 2, 3 and 4 temperature sites. Both T_c and the latent heat $\Delta\epsilon$ are shown to satisfy scaling. The authors find $T_c=208\pm20$ MeV, $\Delta\epsilon/T_c{}^4=3.75\pm0.25$; the latter is in accord with bag model arguments. (18 refs.)

117350 On the consistency of the Wess-Zumino model. C.T.Sachrajda, G.Thompson (Dept. of Phys., Univ. of Southampton, Southampton, England).
Phys. Lett. B (Netherlands), vol.129B, no.6, p.414-16 (6 Oct. 1983).
The authors study the three-point function, $\Gamma(p_1{}^2,\ p_2{}^2,\ p_3{}^2)$, of the Wess-Zumino model in the limit where $p_2{}^2 \simeq p_3{}^y 2 \to \infty$. Contrary to the conclusions of some recent publications, they find that this three-point function can vanish sufficiently quickly in this limit for the Schwinger-Dyson equations to be consistent and without violating other known properties of the model. (5 refs.)

117351 Supersymmetric Yang-Mills theories and twistors. I.V.Volovich (Steklov Math. Inst., Moscow, USSR).
Phys. Lett. B (Netherlands), vol.129B, no.6, p.429-31 (6 Oct. 1983).
A twistor description of the equations of motion for supersymmetric Yang-Mills theories is proposed. Remarkable geometrical properties of the $N=4$ theory are pointed out. (10 refs.)

117352 Second order phase transition in a four-dimensional Z_2 gauge theory. P.Rujan (Inst. for Theoretical Phys., Budapest, Hungary), A.Patkos.
Phys. Lett. B (Netherlands), vol.129B, no.6, p.437-9 (6 Oct. 1983).
The ground state of a Z_2 theory with mixed action is calculated exactly. The vacuum structure implies the existence of a second order transition related to that of the three-dimensional Ising model. (7 refs.)

117353 Canonical quantization of the sine-Gordon system in the multisoliton sector. H.Matsumoto, H.Umezawa (Theoretical Phys. Inst., Univ. of Alberta, Edmonton, Alberta, Canada).
Phys. Rev. D (USA), vol.28, no.6, p.1434-40 (15 Sept. 1983).
The sine-Gordon system is quantized in the presence of several solitons. In direct analogy to the classical conservation laws, one finds new conserved quantum-mechanical operators which form commuting Poincare algebras and which generate relative motions among the solitons. The appearance of the quantum coordinates in the Heisenberg field operator and the form of the Hamiltonian are determined uniquely. Although in the no-particle sector the solitons are noninteracting, it is found that an interaction appears when particle quanta become excited. Though obtained in the context of the sine-Gordon equation, these results are valid for all multisoliton solutions of $(1+1)-$dimensional equations. (9 refs.)

117354 Semiclassical quantization of the complex sine-Gordon field theory. H.J.de Vega, J.M.Maillet (Lab. de Phys. Theorique et Hautes Energies, Univ. Pierre et Marie Curie, Paris, France).
Phys. Rev. D (USA), vol.28, no.6, p.1441-52 (15 Sept. 1983).
The complex sine-Gordon model, a classically integrable field theory which exhibits highly nontrivial renormalization properties, is quantized semiclassically. The classical multisoliton solutions are derived by the inverse scattering method. The semiclassical mass spectrum is obtained from these results by computing the small-fluctuation determinant around the one-soliton solution. Dimensional regularization is used here. The particle spectrum turns out to be constituted by bound states of fundamental particles of like charge. Finally, the semiclassical S matrix is calculated and crossing symmetry is exhibited. (16 refs.)

117355 Boson representation and variational method for O(N) spin systems in 1+1 dimensions. T.Matsui (Dept. of Phys., Purdue Univ., West Lafayette, IN, USA).
Phys. Rev. D (USA), vol.28, no.6, p.1453-60 (15 Sept. 1983).
The author studies the ground state and the correlation functions of O(N) Heisenberg spin systems in $1+1$ dimensions by applying a simple variational method to the Hamiltonian described in a boson representation. The results in our method are compatible with the analysis of the large-N limit. (19 refs.)

117356 New test for spontaneous breakdown of supersymmetry. C.M.Bender (Dept. of Phys., Washington Univ., St. Louis, MO, USA), E.Cooper, A.Das.
Phys. Rev. D (USA), vol.28, no.6, p.1473-80 (15 Sept. 1983).
The authors propose a new nonperturbative test for supersymmetry breaking. The test is first to break supersymmetry by introducing a lattice and then to study the behavior of the ground-state energy as a function of the lattice spacing a. They assume that as a approaches zero, $E_0 \sim ca^\gamma$, where c is a nonzero constant and γ is a critical exponent. If γ is positive as $a \to 0$, the ground-state energy of the continuum theory is zero and the theory is supersymmetric. On the other hand, if γ is zero or negative, then supersymmetry is broken. They verify this test in the context of supersymmetric quantum mechanics using a strong-coupling expansion to calculate E_0 and γ. They find that for the supersymmetric version of g^2x^6 quantum mechanics, $\gamma=1.16\pm0.02$, whereas γ is consistent with zero when we consider the supersymmetric extension of g^2x^4 theory. (9 refs.)

117357 Finiteness of broken $N=4$ super Yang-Mills theory. M.A.Namazie (Internat. Centre for Theoretical Phys., Trieste, italy), A.Salam, J.Strathdee.
Phys. Rev. D (USA), vol.28, no.6, p.1481-90 (15 Sept. 1983).
Using a light-cone gauge formulation for $N=4$ extended supersymmetry, it is shown that an explicit breaking of the supersymmetry by the addition of mass terms does not disturb off-shell finiteness to any order provided the sum of fermion masses equals the sume of scalar masses and appropriate cubic interactions between scalars are included. (14 refs.)

117358 Gauge theories with composite bosons. M.H.Friedman, Y.N.Srivastava (Dept. of Phys., Northeastern Univ., Boston, MA, USA).
Phys. Rev. D (USA), vol.28, no.6, p.1491-5 (15 Sept. 1983).
The authors develop an approach for introducing bosons into gauge theories as composite states of fermions. It is scale and gauge invariant from the outset and utilizes invariant regularization procedures. This results in the acquisition of gauge-covariant kinetic energy by the bosons and the growth of coupling constants and masses. Relationships among the coupling constants and masses are derived. (9 refs.)

117359 Breaking of conservations laws induced by magnetic monopoles in the Rubakov-Callan model. Tung-Mow Yan (Newman Lab. of Nuclear Studies, Cornell Univ., Ithaca, NY, USA).
Phys. Rev. D (USA), vol.28, no.6, p.1496-505 (15 Sept. 1983).
The author has explored further implications of the model of Rubakov and Callan for a gauge theory with massless fermion isodoublets in the presence of a 't Hooft-Polyakov monopole. In a world with only one left-handed isodoublet, the fermion field is found to have a nonzero vacuum expectation value. The author has studied a model with two doublets and find that there exist condensates, some of which break chirality and charge (and color) conservation, and some others conserve chirality but break charge conservation. Unlike the proton-decay catalysis, these effects depend explicitly on the monopole size and are large only in the neighborhood of a monopole. Their existence is shown to be a necessary consequence of the boundary condition in the model. (17 refs.)

117360 Lattice gauge theory in the microcanonical ensemble. D.J.E.Callaway (CERN, Geneve, Switzerland).
Phys. Rev. D (USA), vol.28, no.6, p.1506-14 (15 Sept. 1983).
The microcanonical-ensemble formulation of lattice gauge theory proposed recently is examined in detail. Expectation values in this new ensemble are determined by solving a large set of coupled ordinary differential equations, after the fashion of a molecular dynamics simulation. Following a brief review of the microcanonical ensemble, calculations are performed for the gauge groups U(1), SU(2), and SU(3). The results are compared and contrasted with standard methods of computation. Several advantages of the new formalism are noted. For example, no random numbers are required to update the system. Also, this update is performed in a simultaneous fashion. Thus the microcanonical method presumably adapts well to parallel processing techniques, especially when the action is highly nonlocal (such as when fermions are included). (23 refs.)

117361 Universality conditions for the Lorentz invariance of the Wilson loop in the deconfining phase of the Villain gauge theory. N.Gupte (Inst. for Theoretical Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Rev. D (USA), vol.28, no.6, p.1515-26 (15 Sept. 1983).
The authors has performed gauge-invariant calculations for a four-dimensional Villain field theory where each orientation of the elementary plaquette carries a different weight $E_{\mu\nu}$. There are thus six possible Es in four dimensions. This general theory is interesting because the presence of six Es gives us an insight into universality arguments for four-dimensional gauge theories. It is not necessary that the field theory by Lorentz invariant in the presence of six coupling constants E. It may be necessary to impose some restriction on the six $E_{\mu\nu}$s to make the field theory Lorentz invariant. In this case we would say that 'conditional universality' holds. The theory satisfies 'unconditional universality' if Lorentz invariance holds even if no restrictions are placed on the six Es. The author obtains an expression for the Wilson loop in the nonconfining phase of the Villain gauge theory. The author finds that the Wilson loop is Lorentz invariant despite the fact that no restrictions are placed on the six Es. (12 refs.)

117362 Fermion mutilation on a body-centered tesseract. W.Celmaster, F.Krausz (Northeastern Univ., Boston, MA, USA).
Phys. Rev. D (USA), vol.28, no.6, p.1527-9 (15 Sept. 1983).
The authors construct a chiral Lagrangian on a body-centered four-dimensional hypercubic lattice. A form of fermion doubling is observed in the continuum limit. However, because some of the spurious excitations do not propagate as particles, the resulting continuum field theory is not Lorentz invariant. (14 refs.)

117363 Symmetry behavior in an external field. S.Kawati, G.Konisi, H.Miyata (Dept. of Phys., Kwansei Gakuin Univ., Nishinomiya, Japan).
Phys. Rev. D (USA), vol.28, no.6, p.1537-41 (15 Sept. 1983).
The authors reexamine the recent work about a response of an applied external electromagnetic field to the Gross-Neveu model and comment on the phase transition induced by the external field. They also discuss a four-dimensional model exposed by a pure magnetic field. (9 refs.)

117364 Classical head-on collisions between charges and monopoles. H.M.Lai, K.Young (Dept. of Phys., Chinese Univ. of Hong Kong, Hong Kong).
Phys. Rev. D (USA), vol.28, no.6, p.1552-3 (15 Sept. 1983).
By considering heat-on collisions, it is shown that the classical theory of point charges and point monopoles is inconsistent if there is no spin. In the presence of spin, the theory is consistent but contains an anomaly, similar to the well-known field-theoretic anomalies. This leads to a simple picture of some aspects of the physics of monopole catalysis of baryon decay. (8 refs.)

117365 Fixed points of $(\phi^6)_3$ and $(\phi^4)_4$ theories. R.D.Pisarski (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).
Phys. Rev. D (USA), vol.28, no.6, p.1554-6 (15 Sept. 1983).
The author suggests how the presence of an ultraviolet and a nontrivial infrared-stable fixed point in $(\phi^6)_3$ theory could be related to the (presumed) absence of any nonzero fixed points in $(\phi^4)_4$ theory. (10 refs.)

117366 Background-field gauge and decoupling of massive fermions in unbroken gauge theories. U.Chattopadhyay (Inst. for Theoretical Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Rev. D (USA), vol.28, no.6, p.1557-9 (15 Sept. 1983).
In an unbroken gauge with coupling constant g containing very heavy fermions of mass M, the low-energy phenomena involving the gauge bosons only can be described by a pure Yang-Mills theory with a different coupling constant g^* which can be determined as a function of g and M order by order in perturbation theory. Working in the background-field gauge the author demonstrates by explicit calculation that the relation between g^* and g and M up to two-loop orders is independent of the gauge-fixing parameter of the original theory. (4 refs.)

117367 Supersymmetric Savvidy state for SU(2), SU(3) and SU(4). D.Kay (Dept. of Phys. & Theoretical Sci. Inst., Simon Fraser Univ., Burnaby, Canada).
Phys. Rev. D (USA), vol.28, no.6, p.1562-5 (15 Sept. 1983).
The Savvidy Ansatz of a covariantly constant background field in a Yang-Mills theory is used to calculate the one-loop quantum correction to the effective energy density in a supersymmetric gauge theory. This is done, with matter fields included, for the gauge groups SU(2), SU(3), and SU(4). The beta function is also calculated, and the author finds that asymptotic freedom is assured for less than 6, 9 and 12 flavors in SU(2), SU(3), and SU(4) respectively. (6 refs.)

117368 Fock space and the gauge invariance. Yu.V.Novozhilov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.69-71 (Aug. 1983). In Russian.
Starting from the Fock space definition of the scalar product a set of gauge invariant multiparticle states is constructed. A gauge choice is made in such a way (for example axial gauges or a light-like gauge) that creation operators transform homogeneously under residual gauge transformations. Then, the equations for phase factors linking creation operators at different points can be formulated in terms of creation operators only. A simple solution is given which ensures the gauge invariance. (5 refs.)

117369 Self-consistent spherically symmetric solutions of the Yang-Mills-Dirac-equations. M.Basler (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Z. Phys. C (Germany), vol.20, no.1, p.57-65 (1983).
The $SU(2)$ Yang-Mills equations coupled self-consistently to an isospin $^1/_2$-Dirac equation are studied. Static spherically symmetric exact analytic solutions are given. They all share the property of infinite energy. (27 refs.)

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11.30 SYMMETRY AND CONSERVATION LAWS

(see also 02.20 Group theory)

117370 Symmetry and symmetry breaking in generalized parastatistics. R.Y.Levine, Y.Tomozawa (Dept. of Phys., Univ. of Michigan, Ann Arbor, MI, USA).
Ann. Phys. (USA), vol.149, no.2, p.457-81 (Sept. 1983).
An analysis is made of the characteristics of internal symmetry and symmetry breaking in a quantum field theory with generalized parastatistics, defined by either double commutation relations or single commutation relations. The connection between the two statistics is clarified. The authors develop a formalism in which statistics is viewed as a dynamical or phase variable of quantum systems. It is shown that the types of Higgs phases possible depend upon statistics. Relationships between physical amplitudes implied by internal symmetry with normal statistics are violated in the case of generalized parastatistics. (3 refs.)

117371 Standard model group: survival of the fittest. H.B.Nielsen (Niels Bohr Inst., Univ. of Copenhagen, Copenhagen, Denmark), N.Brene.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.3, p.396-402 (19 Sept. 1983).
The essential content of this paper is related to random dynamics. The author speculates that the work seen through a sub-Planck-scale microscope has a lattice structure and that the dynamics on this lattice is almost completely random, except for the requirement that the random (plaquette) action is invariant under some 'world (gauge) group'. It is seen that the randomness may lead to spontaneous symmetry breakdown in the vacuum (spontaneous collapse) without explicit appeal to any scalar field associated with the usual Higgs mechanism. It is further argued that the subgroup which survives as the end product of a possible chain of collapses is likely to have certain properties; the most important is that it has a topologically connected center. The standard group i.e. the group of the gauge theory which combines the Salam-Weinberg model with QCD, has this property. (6 refs.)

117372 Monopoles and fermion number violation. B.Sathiapalan, T.Tomaras (California Inst. of Technol., Pasadena, CA, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.3, p.491-507 (19 Sept. 1983).
The Rubakov-Callan phenomenon is generalized to arbitrary fermion representations. The language of 'instanton physics' is used to describe the phenomenon. An argument for the enhancement (in the presence of a monopole) of the violation of anomaly free low-energy symmetries like baryon number is given. The importance of gauge field configurations with half-integral winding numbers is discussed. The case of fermions in the isovector representation is calculated explicitly. (14 refs.)

117373 The multi-fold commutator of variation of potential in chiral model and SDYM field. Ge Mo-lin, Wang Jun-yu (Lanzhou Univ., Lanzhou, China), Wu Yong-shi.
Commun. Theor. Phys. (China), vol.2, no.3, p.1099-106 (1983).
The multi-fold commutator representation of hidden symmetry algebra in principal chiral models and the self-dual Yang-Mills field is explicitly shown. All the variations are taken with respect to the potential A_ξ other than the field quantity g for principal chiral models in defining the usual operator $Q(\xi,\eta)$ to give the G⊗C(t) algebra. (13 refs.)

117374 Irreducible representations of superalgebras B(1,1) and B(0,2). Han Qi-zhi, Sun Hong-zhou (Dept. of Phys., Peking Univ., Peking, China).
Commun. Theor. Phys. (China), vol.2, no.3, p.1137-44 (1983).
In gauge supersymmetry and supersymmetry of nuclei one often meets the superalgebra osp(m/2n). The authors construct all the finite-dimensional irreducible representations of osp(3/2)=B(1,1) and osp(1/4)=B(0,2). The conditions of grade star representations are discussed. Only a part of finite-dimensional irreducible representations of B(1,1) and B(0,2) are grade star representations. These are different from those of B(0,1). (6 refs.)

117375 Fermi-Bose similarity, supersymmetry and generalised numbers. II. Y.Ohnuki (Dept. of Phys., Nagoya Univ., Nagoya, Japan), S.Kamefuchi.
Nuovo Cimento A (Italy), vol.77A, ser.2, no.1, p.99-119 (1 Sept. 1983).
For pt.I see ibid., vol.70, no.4, p.435-59 (1982). The study of generalized of g-numbers is continued in connection mainly with their analytical properties. The notion of the standard form of functions of g-numbers is redefined in a simpler form. Fourier and its inverse transformations are discussed in detail, and delta-functions are defined. It is thereby seen that in many respects g-numbers behave in a way very similar to ordinary, i.e. complex and Grassmann numbers. (5 refs.)

117376 CP violation in K→3π decays. H.-Ya.Cheng (Dept. of Phys., Purdue Univ., West Lafayette, IN, USA).
Phys. Lett. B (Netherlands), vol.129B, no.5, p.357-62 (29 Sept. 1983).
CP-violating effects in $K\to 3\pi$ decays are calculated in a miliweak model, the Weinberg model of CP nonconservation, and are then compared with the results obtained in the Kobayashi-Maskawa model. (22 refs.)

117377 The action principle in superspace. S.P.Misra, T.Pattnaik (Inst. of Phys., Bhubaneswar, India).
Phys. Lett. B (Netherlands), vol.129B, no.6, p.401-4 (6 Oct. 1983).
The authors consider here Schwinger's action principle in superspace and obtain a canonical quantisation for the supervariables. They see that this can be defined in a simple and unambiguous manner with boson and fermion quantisations occurring in one 'packet' when they consider superspace and suitably generalise the action principle. (8 refs.)

117378 Ground-state wave-function 'representation'. E.Gozzi (Dept. of Phys., City Univ. of New York, New York, NY, USA).
Phys. Lett. B (Netherlands), vol.129B, no.6, p.432-6 (6 Oct. 1983).
Starting from a general quantum mechanical system: $H=-{}^1/_2\partial^2/\partial x+U(x)$, the author shows its vacuum-vacuum correlation functions can be derived from a supersymmetric Hamiltonian with superpotential $V=-\ln\psi_0$, where ψ_0 is the ground-state wave function of H. (3 refs.)

117379 Experimental signals for supersymmetric decays of the W and Z bosons. A.H.Chamseddine, P.Nath (Dept. of Phys., Northeastern Univ., Boston, MA, USA), R.Arnowitt.
Phys. Lett. B (Netherlands), vol.129B, no.6, p.445-50 (6 Oct. 1983).
A model independent analysis of the particle spectrum and the interaction vertices of supergravity GUT models is given. The analysis interpolates between the models which produce SU(2)×U(1) breaking at the tree level and those where SU(2)×U(1) is broken dynamically from renormalization group loop corrections. General relations for wino and zino masses are obtained. The decays of W and Z into photino, wino and zino modes and their branching ratios in various leptonic and hadronic channels are discussed for theories which possess a light photino. (9 refs.)

117380 W decay in supergravity GUTs. D.A.Dicus, S.Nandi, X.Tata (Center for Particle Theory, Univ. of Texas, Austin, TX, USA).
Phys. Lett. B (Netherlands), vol.129B, no.6, p.451-5 (6 Oct. 1983).
The authors discuss the decay of the W-boson into supersymmetric particles and the decays of these particles in a unified theory in which gravity breaks $SU_L(2)\times U(1)$. If the decay $W\rightarrow\tilde{W}\tilde{Z}$ is kinematically possible, the subsequent decay of the gauginos may provide a definitive signature for supersymmetry. (14 refs.)

117381 Rare kaon processes as a probe of the top quark and gravitino masses on local supersymmetric (SUSY) theories. A.B.Lahanas, D.V.Nanopoulos (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.129B, no.6, p.461-8 (6 Oct. 1983).
A detailed analysis of the rare K processes in local SUSY theories is given. The top quark mass cannot be much higher than O(100 GeV) without making the gravitino mass lower than O(20 GeV), its present lower bound in local SUSY theories from PETRA and PEP. (22 refs.)

117382 Lifting scalar-quark and -lepton masses with sideways U(1). J.F.McCabe, T.Matsuki, W.W.Wada (Dept. of Phys., Ohio State Univ., Columbus, OH, USA).
Phys. Rev. D (USA), vol.28, no.7, p.1738-44 (1 Oct. 1983).
The authors investigate a model for generating large masses for the scalar partners of the quarks and leptons for supersymmetric SU(5). The gauge group is extended to have sideways U(1) which breaks supersymmetry by the O'Raifeartaigh mechanism and generates scalar masses radiatively, while keeping the fermionic-mass corrections small. An explicit one-loop calculation of the scalar-mass corrections is carried out. For this $SU(5)\otimes U(1)$ model a light scalar partner of the leptons on either the second or the third generation is predicted by anomaly constraints. (18 refs.)

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Asymmetries in $e^+e^-\rightarrow\gamma$, Z_1^0, $Z_2^0...\rightarrow\Sigma_q q\bar{q}\rightarrow 2$ jets due to neutral-current effects in the standard and extended gauge models .... See Entry 117396

A softly broken SUSY SU(5) GUT with no light supersymmetric partners, and massive superspace .... See Entry 117397

de Sitter QED .... See Entry 117404

$Su(2)\times U(1)$ neutral currents from $SU(3)\times U(1)$ .... See Entry 117408

Family symmetries .... See Entry 117410

Deconfining and chiral phase transitions in quantum chromodynamics at finite temperature .... See Entry 117414

Fermion mass generation and electroweak symmetry breaking from colour forces .... See Entry 117417

A new method for fermion Monte Carlo .... See Entry 117418

Critical coupling constants in chiral-symmetry breaking .... See Entry 117419

A lower bound on $|\epsilon'/\epsilon|$ .... See Entry 117420

The role helicity asymmetries could play in the search for supersymmetric interactions .... See Entry 117422

Stochastic geometry of O_2 fermionic strings .... See Entry 117443

Neutral-current effects in the standard and extended gauge models for spin polarization effects in $e^+e^-\rightarrow\mu^+\mu^-$ .... See Entry 117450

Experimental outlook [strangeness energy sources] .... See Entry 117455

Further experimental test of nucleon charge conservation through the reaction $^{13}Cd\rightarrow{}^{113m}In+$neutrals .... See Entry 117460

Electromagnetic decays of vector and axial mesons $\rho\rightarrow\pi+l^++l^-$ and $A_1\rightarrow\pi+l^++l^-$ .... See Entry 117470

The general structure of polarization characteristics in deuteron electrodsintegration .... See Entry 117477

Broken supersymmetric QCD and e^+e^- hadronic cross sections .... See Entry 117483

Numerical test of a modified boson method for multi-phonon states. Single j-shell case .... See Entry 117530

Limit on Im (C_SC_A*) from a test of T invariance in ^{19}Ne beta decay .... See Entry 117551

11.40 CURRENTS AND THEIR PROPERTIES

117383 Strong radiative corrections to strangeness-changing processes in the presence of right-handed currents. I.I.Bigi (Inst. fur Theoretische Phys., RWTH Aachen, Aachen, Germany), J.-M.Frere.
Phys. Lett. B (Netherlands), vol.129B, no.6, p.469-72 (6 Oct. 1983).
In the presence of weak right-handed currents the GIM suppression becomes less efficient in the effective $\Delta S=2$ operator. Therefore new features arise and have to be taken into account when applying strong radiative corrections. The authors determine these QCD corrections to the $\Delta S=2$ operator on the leading log level and (in contrast to the standard model) find a sizeable enhancement. If one ascribes *CP* violation to the presence of right-handed currents, then the parameter ϵ will enjoy the same enhancement. They shows however, that ϵ' is increased in a similar way; the ratio ϵ'/ϵ is therefore not significantly affected. (7 refs.)

Axial-vector anomaly for Dirac-Kahler fermions on the lattice .... See Entry 117312

Infinitesimal symmetries and conserved currents for nonlinear Dirac equations .... See Entry 117327

11.50 DISPERSION RELATIONS AND SUM RULES

Finite-energy sum rules and light-quark masses .... See Entry 117448

Proton and neutron magnetic moments from QCD sum rules .... See Entry 117466

New measurement of deep-inelastic *e-p* asymmetries .... See Entry 117473

12.00 SPECIFIC THEORIES AND INTERACTION MODELS; PARTICLE SYSTEMATICS

12.10 UNIFIED FIELD THEORIES AND MODELS

117384 Issues in the standard model. M.K.Gaillard (Fermi Nat. Lab., Batavia, IL, USA).
AIP Conf. Proc. (USA), no.102, p.54-67 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
Focusing on the standard electroweak model, the author examines physics issues which may be addressed with the help of intense beams of strange particles. (29 refs.)

117385 Calculating $|\epsilon'/\epsilon|$ in $SU(2)_L\times SU(2)_R\times U(1)$ gauge models. G.C.Branco (Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
AIP Conf. Proc. (USA), no.102, p.94-8 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
A calculation of the $|\epsilon\ 2n/\epsilon|$ ratio in electroweak models based on $SU(2)_L\times SU(2)_R\times U(1)$ is presented. The authors shows that there is a class of theories where $|\epsilon'/\epsilon|$ is either vanishing or very small ($|\epsilon'/\epsilon|\approx 10^{-4}$). From the known strength of CP violation in the neutral kaon system, the author obtains a constraint on the mass of the righthanded gauge boson: $M_{W(R)}{}^2\approx 10^5 M_{W(L)}{}^2$. (12 refs.)

117386 Left-right symmetry and CP violation. R.N.Mohapatra (Univ. of Maryland, College Park, MD, USA), G.Senjanovic.
AIP Conf. Proc. (USA), no.102, p.99-106 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
A review of left-right symmetry and its possible connection to CP-violation is presented. The author also summarizes the experimental situation regarding M_R, the mass scale of parity restoration and discuss the general features of quark mass matrices in these theories. (17 refs.)

117387 CP-violation through Higgs exchange. N.G.Deshpande (Dept. of Phys., Univ. of Oregon, Eugene, OR, USA).
AIP Conf. Proc. (USA), no.102, p.107-13 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
The author reviews the Weinberg model of CP nonconcservation through the exchange of Higgs bosons. When possible long distance contribution to K-$\bar{K}$ mass matrix are included, the model is barely compatible with the limit for ϵ'/ϵ obtained from experiment. The author also discusses the electric dipole moment (e.d.m.) of the neutron in this model. (17 refs.)

117388 On the strong CP problem in theories with several Higgs doubles and in supersymmetric models. I.I.Bigi (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
AIP Conf. Proc. (USA), no.102, p.115-18 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
The author discusses CP violation in supersymmetric models with Higgs doublets. A solution is considered up to a seven loop level and a detailed computation made in the Weinberg ansatz. (12 refs.)

117389 CP-violation in supersymmetric theories. M.B.Gavela (Brandeis Univ., Waltham, MA, USA).
AIP Conf. Proc. (USA), no.102, p.119-22 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
The author discusses sources of CP violation specific to supersymmetric theories. CP-violating phases may appear: (a) in the mass matrices of the gauge and Higgs fermions: (b) in the mixing between the scalar quarks; (c) in the gauge coupling (revisit of the supersymmetric version of the Kobayashi-Maskawa model). The author estimates its effect on the electric dipole moment of the electron and the neutron. In some cases, it is found to be close to the experimental upper bounds. (10 refs.)

117390 Rare K and μ decays: theoretical and experimental status and prospects. G.L.Kane (Phys. Dept., Univ. of Michigan, Ann Arbor, MI, USA), R.E.Shrock.
AIP Conf. Proc. (USA), no.102, p.123-54 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
The authors discuss occurrence of rare decays and how these affect the standard unified model. (87 refs.)

117391 Hyperron decays and a limit on left-right mixing. J.M.Frere (Randall Lab. of Phys., Univ. of michigan, Ann Arbor, MI, USA), I.I.Bigi.
AIP Conf. Proc. (USA), no.102, p.163-4 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
Left-right symmetrical models, based on the group $SU(2)_L \times SU(2)_R \times U(1)$ have often been discussed as a somewhat minimal extension of the standard group $SU(2)_L \times U(1)$. As far as low-energy charged current gauge interactions are concerned, a need to introduce two new parameters, namely the mass of the hypothetical right-handfed boson, M_R and its mixing with the left-handed boson, characterized by $\sin\xi$ which lead respectively to effective (V+A) $(V+A).G_F/\sqrt{2}.M_L{}^2/M_R{}^2$ and $(V+A)(V-A).G_F/$ 3t2.$\sin\xi$ four-fermion interactions. The authors have suggested that a Majorana mass-independent limit on ξ be obtained by considering deep inelastic $\bar{\nu}$ scattering at large values of x and y. (2 refs.)

117392 Neutrino physics with intense beams. B.Kayser (Nat. Sci. Found., Washington, DC, USA), S.P.Rosen.
AIP Conf. Proc. (USA), no.102, p.165-9 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
Intense, low-energy neutrino beams would make possible a variety of interesting experimental tests of the standard model. A number of these tests are described. (11 refs.)

117393 Theoretical perspectives on strange physics. J.Ellis (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
AIP Conf. Proc. (USA), no.102, p.191-23 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
The author discusses various unification models and their respective theoretical ideas. The K^0-$\bar{K}^0$ system is considered as a possible test of quantum theory. The future exploration of strange physics is discussed. (107 refs.)

117394 Monopolonium. C.T.Hill (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.3, p.469-90 (19 Sept. 1983).
The author examines the general properties of a monopole anti-monopole bound state. Lifetimes grow as the cure of the initial diameter and range, for an SU(5) GUT monopole with mass$=2\times10^{16}$ GeV, from about 43 days for $d=1$ fm, to 10^{11} years for $d=0.1$ angstrom. He finds about 10^7 hadrons are produced by fragmentation of gluons are radiated by classical Larmor radiation. In the final burst when the extended cores overlap about 25 fundamental degrees of freedom of the full unified gauge group are produced. He finds that such objects would have been produced in the early universe at about the time of helium synthesis and their decay products and Larmor radiation may be observable. (12 refs.)

117395 One possibility of extension of the symmetry group of the Weinberg-Salam model. II. The experimental data analysis. S.F.Sultanov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.1, p.67-71 (1983). In Russian.
Restrictions on the mass and coupling constants of *X*-bosons introduced in the framework of the extended symmetry of the electroweak interaction, and following from the experimental data on leptonic processes, have been found. (8 refs.)

117396 Asymmetries in $e^+e^- \rightarrow \gamma, Z_1{}^0, Z_2{}^0 \ldots \rightarrow \Sigma_q q\bar{q} \rightarrow 2$ jets due to neutral-current effects in the standard and extended gauge models. M.Hayashi, K.Katsuura (Dept. of Phys., Saitama Medical Coll., Saitama, Japan), S.Homma.
Nuovo Cimento A (Italy), vol.76A, ser.2, no.3, p.509-24 (1 Aug. 1983).
The authors study various observables (total cross-section, forward-backward asymmetry, asymmetry due to beam polarization, etc.) in which the neutral-current effects manifest themselves in the reaction $e^+e^- \rightarrow \gamma, Z_1{}^0, Z_2{}^0 \ldots \rightarrow \Sigma_q q\bar{q} \rightarrow 2$ jets induced by (longitudinally and transversely) polarized as well as unpolarized e^+e^- beams. They evaluate these quantities and investigate the effects of the beam polarizations in the energy range GeV $10 \lesssim \sqrt{8} \lesssim 200$ GeV adopting as the gauge models for the electroweak interaction the Weinberg-Salam model, the ones based on $SU_2 \times U_1 \times [U_1]'$ and on $SU_2 \times U_1 \times [SU_2]'$. They point out that at ~60 GeV (a typical energy at TRISTAN) the measurement of the forward-backward asymmetry for down-quarks $A_{FB}{}^d$ by longitudinally polarized beams can be useful in testing the models. At ~160 GeV (a typical energy at LEP) the measurements of the energy dependence of various asymmetries together with the one of the total cross-section using different polarized beams can clearly test the models. (12 refs.)

117397 A softly broken SUSY SU(5) GUT with no light supersymmetric partners, and massive superspace. K.T.Mahanthappa, G.M.Staebler (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA).
Phys. Lett. B (Netherlands), vol.129B, no.5, p.298-302 (29 Sept. 1983).
A softly broken supersymmetric grand unified theory based on SU(5) with no light superpartners is constructed. The model does not involve fine tuning and gives rise to a stable hierarchy. The choice of mass parameters is dictated by the massive superspace. All superpartners of ordinary particles have masses $\gtrsim 10^{11}$ GeV. The proton decay proceeds via dimension-5 operators and is mediated by squarks, sleptons, shiggses and gaugions leading to a lifetime $>10^{32}$ yr. The cosmological constant is zero. (10 refs.)

117398 Fractional charges, monopoles and peculiar photons in SO(18) GUT models. Fang-xiao Dong, Tung-sleng Tu, Pei-yun Xue, Xyan-jian Zhou (Inst. of High Energy Phys., Acad. Sinica, Beijing, China).
Phys. Lett. B (Netherlands), vol.129B, no.6, p.405-10 (6 Oct. 1983).
Some SO(18) GUT models are proposed with can accommodate fractional charged color singlets with ordinary charge $\pm e/2$ and a monopole with ordinary magnetic charge $1/2e$. The models are consistent with the Dirac quantisation rule and peculiar photons appear. Future experimental tests of the peculiar photons are discussed. The models can also accommodate four or six generations of ordinary quarks and leptons. (9 refs.)

117399 The independence of mass scales in inverse hierarchy models. R.A.Flores (Det. of Phys., Univ. of California, Santa Cruz, CA, USA), M.Sher.
Phys. Lett. B (Netherlands), vol.129B, no.6, p.411-13 (6 Oct. 1983).
In inverse hierarchy models, one attempts to 'solve' the hierarchy problem by generating a large scale *X* from a theory with only a smaller scale *M*. Einhorn and Jones have argued (1983), however, that *M* and *X* are essentially independent scales, even though the ratio appears to be calculable. The authors consider a model in which the same phenomenon occurs, and show that it is identical to the more familiar near-Coleman-Weinberg' models. As the latter clearly have two independent scales, one put in by hand and the other generated by dimensional transmutation, they argue that inverse hierarchy models also have two independent scales, thus agreeing with the more detailed analysis of Einhorn and Jones. (4 refs.)

117400 Natural generation of fermion masses. S.Dimopoulos (Dept. of Phys., Stanford Univ., Stanford, CA, USA).
Phys. Lett. B (Netherlands), vol.129B, no.6, p.417-28 (6 Oct. 1983).
A class of grand unified theories is proposed in which the quark and lepton mass matrices are computed in terms of 4 input parameters via elementary group theory. These theories do not contain any small Yukawa couplings. The author works out several examples; some models agree with experiment to better than 30%; several theories predict surprisingly long b→c lifetimes; a favored value of the top quark mass is 6 times the bottom mass. Naturalness arguments strongly suggest the existence of a fourth generation at the weak scale. (13 refs.)

117401 Constraints on proton lifetime and $\sin^2\theta_W$ in SO(10) grand unified theory. Y.Tosa, G.C.Branco, R.E.Marshak (Dept. of Phys., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Phys. Rev. D (USA), vol.28, no.7, p.1731-7 (1 Oct. 1983).
Simple constraints on the proton-decay lifetime are derived in SO(10) grand unified theory for major descents to the standard group $SU(3)_C \times SU(2)_L \times U(1)_Y$. It is shown that the only unambiguous pattern of symmetry breaking that predicts a longer proton lifetime [than SU(5)] goes through the Pati-Salam group $SU(4) \times SU(2)_L \times SU(2)_R$ and distinguishes quarks from leptons [i.e. SU(4) breaks down to $SU(3)_C \times U(1)_{B-L}$] before parity is broken [i.e. $SU(2)_R$ is broken]. The lifetime depends on M_R [the mass scale associated with $SU(2)_R$ breaking] but neither on the other intermediate mass scales nor on $\sin^2\theta_W$ in the limit where Higgs-boson contributions are neglected. (25 refs.)

Theoretical Symposium on Intense Medium Energy Sources of Strangeness .... See Entry 116910

'What God hath put asunder, let no man join together'. The grand unification problem .... See Entry 117061

Standard model group: survival of the fittest .... See Entry 117371

CP violation in K→3π decays .... See Entry 117376

Experimental signals for supersymmetric decays of the W and Z bosons .... See Entry 117379

W decay in supergravity GUTs .... See Entry 117380

Fermion mass generation and electroweak symmetry breaking from colour forces .... See Entry 117417

Dynamical interpretation of the technifermion approach motivated by composite gravity .... See Entry 117421

Finite-energy sum rules and light-quark masses .... See Entry 117448

Neutral-current effects in the standard and extended gauge models for spin polarization effects in $e^+e^- \rightarrow \mu^+\mu^-$ .... See Entry 117450

12.20 MODELS OF ELECTROMAGNETIC INTERACTIONS

117402 Relativistic spin-dependent Compton scattering from electrons. G.Bhatt, H.Grotch, E.Kazes (Dept. of Phys., Pennsylvania State Univ., University Park, PA, USA), D.A.Owen.
Phys. Rev. A (USA), vol.28, no.4, p.2195-200 (Oct. 1983).
The differential cross section for photon scattering from relativistic polarized free electrons in motion is derived. The calculation extends early results from electrons at rest. It is argued that the present derivation is required for use in bound-state spin-dependent Compton scattering from polarized electrons. The results provide an alternative check on recent work carried out using a quasirelativistic Hamiltonian. (14 refs.)

The constancy of the laws of physics in the light of prehistoric nuclear reactors .... See Entry 116944

12.20D Specific calculations and limits of quantum electrodynamics

117403 Electromagnetic Casimir densities in dielectric spherical media. I.Brevik, H.Kolbenstvedt.
Ann. Phys. (USA), vol.149, no.2, p.237-53 (Sept. 1983).
Local expectation values of the electromagnetic energy density, and of the quantity $^1/_4G^2={}^1/_2(\mathbf{H}.\mathbf{B}-\mathbf{E}.\mathbf{D})$, are calculated both inside and outside a spherical surface dividing two media of permeabilities μ_1 and μ_2. In both media the relationship $\epsilon\mu=1$ is assumed, where ϵ is the permittivity. The powerful source theory method is used. The results are displayed graphically, although analytical approximate expressions for the field densities are obtained near the surface. The formalism is general enough to describe QED and QCD cavities (to zeroth order in the gauge coupling constant) on the same footing, as limiting cases. Retaining the cutoff parameter at a finite value, it is finally shown how the large interior and exterior cutoff terms compensate each other in the global Casimir energy. (19 refs.)

117404 de Sitter QED. B.Binegar, C.Fronsdal, W.Heidenreich (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Ann. Phys. (USA), vol.149, no.2, p.254-72 (Sept. 1983).
Attention is called to the fact that the well-known and straightforward generalization of electrodynamics to de Sitter space is incompatible with conformal invariance. In addition, there is difficulty in reconciling the space of one-photon states in de Sitter QED, for which the field carried no degree of freedom related to helicity, with that of flat space QED in which both signs of the helicity appear. The requirement of conformal invariance leads to the introduction of two vector potentials in de Sitter electrodynamics and resolves the helicity problem. A conformally-invariant indefinite metric quantization is carried out, and the nature of the flat space limit is clarified. Implications for a theory of composite massless particles are discussed, as well as applications to supersymmetry and supergravity. (12 refs.)

117405 The quantum electrodynamics in a constant magnetic field—the perturbation theory in Furry picture. Song Yu (Inst. of High Energy Phys., Acad. Sinica, Peking, China).
Commun. Theor. Phys. (China), vol.2, no.3, p.1081-97 (1983).
The second quantization in Furry picture is carried out, the perturbation theory is built up and a new method for investigating the electromagnetic phenomena in a constant magnetic field is proposed. Since the treatment of this method is exact, it is especially suitable for very high magnetic fields. (3 refs.)

117406 The photon in pseudoclassical mechanics. A.Barducci (Dept. de Phys. Theorique, Univ. de Geneve, Geneve, Switzerland), L.Lusanna.
Nuovo Cimento A (Italy), vol.77A, ser.2, no.1, p.39-75 (1 Sept. 1983).
The authors describe a massless particle belonging to the $D_{1,0}\oplus D_{0,1}$ representation of $SL_{2,c}$ by means of pseudoclassical mechanics, starting by a set of first-class constraints. By canonical quantization one obtains the one-photon wave functions in the Lorentz gauge, whereas by path integral quantization one finds the noncovariant transverse free propagator. In the reduced phase space, the canonical variables are manifestly covariant only under $O_2\otimes R^4$ and can be quantized by using the Angelopoulos-Bayen-Flato operators. By means of a distribution function ρ on the Grassmann variables the authors obtain the description of a classical ray of light with the associated Stokes parameters. The quantization of ρ gives the quantum Stokes parameters. (57 refs.)

12.25 MODELS FOR GRAVITATIONAL INTERACTIONS

(see also 04.60 Quantum theory of gravitation)

Dynamical interpretation of the technifermion approach motivated by composite gravity .... See Entry 117421

12.30 MODELS OF WEAK INTERACTIONS

117407 Testing the standard model versus left-right models on the off the *Z* resonance. V.Barger (Dept. of Phys., Univ. of Durham, Durham, England), E.Ma, K.Whisnant.
Phys. Rev. D (USA), vol.28, no.7, p.1618-27 (1 Oct. 1983).
The authors examine the high-energy predictions of left-right models which are consistent with constraints from low-energy data. These are compared to the predictions of the standard electroweak gauge model to determine how well the theories can be distinguished by measurements in this mass region of the standard Z boson resonance. They find a nontrivial class of left-right models in which the lowest-mass Z is indistiguishable in mass and fermion couplings from the standard Z, but which allow a second Z boson as low as 200 GeV. They discuss the sensitivity of the lower limit on the second-Z mass to the results of the atomic parity-violation measurement and find that the newest data relaxes, the mass limit in a general left-right model to $M_{Z2}\gtrsim 150$ GeV. (34 refs.)

117408 Su(2)×U(1) neutral currents from SU(3)×U(1). M.Singer, K.S.Viswanathan (Dept. of Phys., Simon Fraser Univ., Burnaby, BC, Canada).
Phys. Rev. D (USA), vol.28, no.7, p.1721-30 (1 Oct. 1983).
A simple $SU(3)_L\times U(1)$ model of weak-electromagnetic interactions in which there is one new neutral-current parameter R_1 is shown to give the/$SU(2)_L\times U(1)$ muon-neutrino and electron neutral-current predictions for all values of R_1. For R_1 of the order 1, one of the two neutral gauge bosons is lighter than the charge gauge boson. By changing the charge assignments on the original model, one can also construct a new set of models which reproduces the muon-neutrino neutral currents, and gives predictions for electron neutral-current interactions which are consistent with experiment. (30 refs.)

117409 Evolution condition for electroweak interactions in composite models. P.Chen, F.M.Renard (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
Phys. Rev. D (USA), vol.28, no.7, p.1758-69 (1 Oct. 1983).
The authors impose the requirement of good-high-energy behavior of $f\bar{f}\rightarrow W^+W^-$ scattering amplitudes for effective theory of electroweak interactions in composite models. They find that there exists a set of constraints on the form factors which they call the 'evolution condition' and which any such theory should obey. According to this condition the elecromagnetic and weak interactions are 'unified' in a less stringent way than by the so-called 'unification condition'. In addition, the effective theory should have a well defined evolution governed by the constraints on the form factors. The authors have checked this condition on several γ-W mixing schemes. Possible experimental tests are discussed. (18 refs.)

A trouble for composite quark and lepton models? .... See Entry 117437

$K\rightarrow\pi$+light pseudoscalar .... See Entry 117456

Calculation of weak neutral currents by the electro-production of pions on nucleons close to the nucleon resonances in the parton-quark model .... See Entry 117474

12.35 COMPOSITE MODELS OF PARTICLES

117410 Family symmetries. F.Wilczek (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).
AIP Conf. Proc. (USA), no.102, p.68-72 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
Advantages to theories with spontaneous breakdown of flavor symmetries are reviewed. A possible experimental signature in rare K-decays is discussed. One particularly attractive breakdown scheme is pointed out, and its consequences for mixing angles described. Recent ideas concerning axions, and their possible cosmological significance, are briefly discussed. The relevance of Cavendish-type experiments in testing for axions and familons is mentioned. (4 refs.)

$K\rightarrow\pi$+light pseudoscalar .... See Entry 117456

12.35C General properties of quantum chromodynamics (dynamics, confinement, etc.)

117411 Quarks, partons and quantum chromodynamics. J.Chyla (Fyzikalni Ustav CSAV, Praha, Czechoslovakia).
Cesk. Cas. Fyz. Sekce A (Czechoslovakia), vol.33, no.4, p.321-51 (1983). In Czech.
Contains a detailed exposition of the basics of perturbative quantum chromodynamics and a discussion of its relation to the parton model of hadrons. (23 refs.)

117412 On a non-perturbative approach to quantum chromodynamics. S.Olejnik (Fyzikalny Ustav CEFV SAV, Bratislava, Czechoslovakia).
Cesk. Cas. Fyz. Sekce A (Czechoslovakia), vol.33, no.4, p.352-72 (1983). In Czech.
Explains in detail results of a Feynman's work in which reasons for the confinement of quarks and for a non-zero mass of the lowest-lying excitations of a simplified planar model of chromodynamics were quantitatively shown. It also contains a brief review of some other non-perturbative approaches to the quantum chromodynamics. (25 refs.)

117413 Testing QCD at the proton-antiproton collider. W.Furmanski (LPTHE, Orsay, France), H.Kowalski.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.3, p.523-36 (19 Sept. 1983).
The recent UA1 and UA2 data for large-p_T jet production are compared with the predictions of perturbative QCD. Using the standard leading log QCD formula and neglecting all corrections (higher orders, higher twists), the authors find a good agreement with the UA1 data. On the other hand, the UA2 data are below their predictions. The theoretical uncertaintities due to the value of Λ and to the detailed shape of the gluon distribution are within the experimental errors of the UA1 data. (15 refs.)

117414 Deconfining and chiral phase transitions in quantum chromodynamics at finite temperature. T.Banks (Inst. for Theoretical Phys., Stanford Univ., Stanford, CA, USA), A.Ukawa.
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B225(FS9), no.1, p.145-55 (3 Oct. 1983).
The authors give further arguments to support the claim of Svetsky and Yaffe that the finite-temperature transition in 4-dimensional SU(N) gauge theories is in the universality class of 3-dimensional Z_N spin models. They show that this implies a smoothing out of the transition when quarks are added to the system as long as $N\neq 3$. For $N=3$ the pure gauge transition is expected to be first order and will be smoothed by quarks only if the quark contribution to the internal energy is larger than the latent heat of transition. (23 refs.)

117415 Pionic corrections and mulit-quark bags. P.J.Mulders (Center for Theoretical Phys., MIT, Cambridge, MA, USA), A.W.Thomas.
J. Phys. G (GB), vol.9, no.10, p.1159-67 (Oct. 1983).
The authors investigate the influence of pionic corrections on multi-quark hadrons. After determining the bag parameters from ordinary baryons and mesons, they discuss the implications for six-quark configurations. (34 refs.)

117416 Renormalization of the two-gluon exchange contributions to high-temperature interquark potential. Zhao Wanyun (Internat. School for Advanced Studies, Trieste, Italy).
Nuovo Cimento A (Italy), vol.76A, ser.2, no.3, p.525-38 (1 Aug. 1983).
The renormalization of the two-gluon contributions to high-temperature interquark potential within the framework of perturbation theory has been studied. The result is that the quarks are unconfined at high temperature, which is consistent with the Monte Carlo study of lattice gauge theory at high temperature. The infra-red problem is also discussed. (9 refs.)

117417 Fermion mass generation and electroweak symmetry breaking from colour forces. G.Zoupanos (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.129B, no.5, p.315-19 (29 Sept. 1983).
The colour gauge group is extended to $SU(3)\otimes SU(3)$ and is subsequently broken to diagonal $SU(3)_c$. Under the diagonal $SU(3)_c$ the fundamental fermionic constituents of the larger strong group become ordinary quarks plus new quarks with exotic quantum numbers. Chiral symmetry breaking in the exotic quark sector may occur at much larger mass scales than ordinary chiral symmetry breaking, and could produce dynamical breaking of electroweak gauge symmetry and radiative masses for the light fermions. (17 refs.)

117418 A new method for fermion Monte Carlo. G.Bhanot, U.M.Heller (Inst. for Advanced Study, Princeton, NJ, USA), I.O.Stamatescu.
Phys. Lett. B (Netherlands), vol.129B, no.6, p.440-4 (6 Oct. 1983).
The authors suggest a new method using boson fields to compute the ratio of two determinants. The advantages of this method over others described in the literature are outlined. Some studies of the use of the method in two- and four-dimensional QCD with the gauge group SU(2) on small lattices are presented. (12 refs.)

117419 Critical coupling constants in chiral-symmetry breaking. A.Amer, A.Le Yaouanc, L.Oliver, O.Pene, J.-C.Raynal (Lab. de Phys., Theorique et Hautes Energies, Univ. Paris-Sud, Orsay, France).
Phys. Rev. D (USA), vol.28, no.6, p.1530-6 (15 Sept. 1983).
Finger, Horn, and Mandula showed in a Tamm-Dancoff approximation in QCD that Coulomb exchange induces instability of the chiral-invariant vacuum for $\alpha_5>\alpha_s{}^{\mathrm{crit}}$ in the sense that for $\alpha_s>\alpha_s{}^{\mathrm{crit}}$ there are negative eigenvalues of an operator H derived by them. The authors show that another critical coupling constant $\alpha_s{}^{\prime\mathrm{crit}}>\alpha_s{}^{\mathrm{crit}}$ is more meaningful. For $\alpha_s>\alpha_s{}^{\prime\mathrm{crit}}$ there is no positive self-adjoint extension of H; for $\alpha_s<\alpha_s{}^{\prime\mathrm{crit}}$ there is at least one; when $\alpha_s{}^{\mathrm{crit}}<\alpha_s<\alpha_s{}^{\prime\mathrm{crit}}$, among several self-adjoint extensions, a positive one is singled out by the physical requirement of a finite kinetic-energy expectation value. Considering, respectively, Coulomb exchange with the Tamm-Dancoff approximation, Coulomb exchange with the Bogoliubov-Valatin approximation, and Coulomb exchange plus transverse-gluon exchange, the values are ${}^4/_3\alpha_s{}^{\prime\mathrm{crit}}=8\pi/(4+\pi^2)$, $4/\pi$, $12/5\pi$ to be compared with ${}^4/_3\alpha_s{}^{\mathrm{crit}}={}^3/_2$, 1, $\pi/1(3\pi-4)$. (11 refs.)

Strong radiative corrections to strangeness-changing processes in the presence of right-handed currents .... See Entry 117383

Electromagnetic Casimir densities in dielectric spherical media .... See Entry 117403

Jet reconstruction in collider events using digital filtering ...... See Entry 117442

An analysis on the color Van der Waals force .... See Entry 117446

Reggeized quark multiperipheral model for dual sheets ....See Entry 117447

The hadron structure functions in the bag model and their modifications ....See Entry 117463

Leptoquark production at HERA ....See Entry 117472

The triton binding energy and nd-scattering lengths with account of a quark nucleon structure ....See Entry 117519

Collisions to melt the vacuum ....See Entry 117586

12.35E Applications of quantum chromodynamics to particle properties and reactions

117420 A lower bound on $|\epsilon'/\epsilon|$. J.S.Hagelin, F.J.Gilman (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
AIP Conf. Proc. (USA), no.102, p.87-93 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
In the Kobayashi-Maskawa (K-M) model, a lower bound on the CP violating product $s_2c_2s_3s_\delta$ follows from the imaginary part of the short-distance K^0-$\bar{K}^0$ mixing amplitude together with a conservative upper bound on the short distance contribution to $K_L \rightarrow \mu\mu$. This leads to a lower boundd on $|\epsilon'/\epsilon|$ in terms of a matrix element of a single $(V-A)\times(V+A)$ type operator. Familiar current algebra and bag model estimates for this matrix element give $|\epsilon'/\epsilon|>2\times10^{-3}$. The authors also observe that the experimental upper bound on the branching ratio for the b-quark into u-quarks fixes the sign of $s_2c_2s_3s_\delta$ and ϵ'/ϵ both to be positive. Allowances for QCD corrections and long distance effects are included throughout the analysis. (19 refs.)

117421 Dynamical interpretation of the technifermion approach motivated by composite gravity. H.Saller (Max-Planck-Inst. fur Phys. und Astrophys., Munich, Germany).
Nuovo Cimento A (Italy), vol.77A, ser.2, no.2, p.214-30 (21 Sept. 1983).
The algebraic connection of ordinary and technifermions by an extended technicolour group is reinterpreted as an analytic connection involving their dilatation properties. An embedding of the ordinary fermions into such a 'dilatation proliferation' is motivated by the conformal part of the gravitational interaction. Newton's constant (or the Planck mass) gives the scale for the interaction of the ordinary and technifermions in this extended scheme. The internal gauge bosons arise as composites. The mass splitting of the technifermions, appearing locally in parity doublets, is the relevant scale for the Higgs phenomenon. (12 refs.)

117422 The role helicity asymmetries could play in the search for supersymmetric interactions. N.S.Graigie (Internat. Centre for Theoretical Phys., Trieste, Italy), K.Hidaka, P.Ratcliffe.
Phys. Lett. B (Netherlands), vol.129B, no.5, p.310-14 (29 Sept. 1983).
The authors give the Born cross sections and polarization asymmetries for the supersymmetric version of QCD and describe how these could be exploited in the search for evidence of gluinos by establishing that missing energy events are indeed due to spin 1/2 particles. The interactions most relevant for collider energies are discussed. (6 refs.)

117423 The effect of confinement size on nuclear structure functions. F.E.Close, R.G.Roberts, G.G.Ross (Rutherford Appleton Lab., Didcot, England).
Phys. Lett. B (Netherlands), vol.129B, no.5, p.346-50 (29 Sept. 1983).
The authors consider the differences in the structure function of a heavy nucleus, such as iron, compared to a light nucleus. They investigate, in the context of QCD, a suggestion that these differences arise as a result of differences in the scale of confinement of the nuclear constituents. This results in a simple relationship between heavy and light nucleus structure functions which is in reasonable agreement with experiment if the confinement size in iron is around 10-20% greater than in a free nucleon. (11 refs.)

117424 Mesons wwith excited glue. L.A.Griffiths, C.Michael, P.E.L.Rakow (Dept. of Appl. Math. & Theoretical Phys., Univ. of Liverpool, Liverpool, England).
Phys. Lett. B (Netherlands), vol.129B, no.5, p.351-6 (29 Sept. 1983).
The potential function for all possible excitations of a gluonic string with fixed ends is extracted from lattice Monte Carlo calculations using a variational technique. The spectrum of mesonic states, including those with exotic J^{PC}, is presented. (8 refs.)

117425 Dimensionally regularized two-loop on-shell quark form factor. R.J.Gonsalves (Dept. of Phys. & Astron., State Univ. of New York, Amherst, NY, USA).
Phys. Rev. D (USA), vol.28, no.6, p.1542-9 (15 Sept. 1983).
Analytic results are presented for the dimensionally regularized two-loop Feynman diagrams which contribute to the electromagnetic form factor of an on-shell quark in massless quantum chromodynamics. (22 refs.)

117426 On the exponentiation of soft-gluon large corrections. A.P.Contogouris, L.Marleau (Dept. of Phys., McGill Univ., Montreal, Canada).
Phys. Rev. D (USA), vol.28, no.7, p.1644-58 (1 Oct. 1983).
For Drell-Yan dilepton production to order α_s^2 (two-loop level) in the dimensional-regularization approach the authors study the question of exponentiation of π^2 terms arising from soft-gluon perturbative corrections. (22 refs.)

117427 Two-gluino bound states and heavy quarkonium. J.Zuk, G.C.Joshi, J.W.G.Wignall (School of Phys., Univ. of Melbourne, Parkville, Victoria, Australia).
Phys. Rev. D (USA), vol.28, no.7, p.1706-15 (1 Oct. 1983).
A supersymmetric octet QCD, incorporating interacting gluons and gluinos, is formulated and used to discuss the features of two-gluino bound states. The short-range gluino-gluino potential is calculated and it is assumed that the complete potential, including the color-confining part, has the same form as the quark-antiquark potential but multiplied by the color factor derived for the short-range part. A spin-dependent mass formula based on a quark-antiquark potential of the Martin single-power type is fitted to the known triplet and singlet states of heavy quarkonia and is then used to make predictions of the mass spectra of ^3S, ^1P, and ^3D gluino-gluino bound states. It is found the relative energy spacings of these states are almost independent of gluino mass m_λ for $m_\lambda \gtrsim 5$ GeV, the experimental lower limit. (26 refs.)

117428 Quantum-chromodynamic potential model for light and heavy quarkonia. S.N.Gupta, S.F.Radford (Dept. of Phys., Wayne State Univ., Detroit, MI, USA), W.W.Repko.
Phys. Rev. D (USA), vol.28, no.7, p.1716-20 (1 Oct. 1983).
The authors' earlier treatment for the investigation of the $c\bar{c}$, $b\bar{b}$, and $t\bar{t}$ spectra is extended to other quarkonia with u, d, s, c, and b quarks. They find that it is possible to account fully for the observed ground-state hyperfine splittings of light as well as heavy quarkonia provided that the perturbative quantum-chromodynamic potential is supplemented not only by the nonperturbative confining potential but also by a nonperturbative annihilation potential which rapidly decreases with increase in the quark mass. They also give predictions for the experimentally interesting $b\bar{u}$, $b\bar{s}$, and $b\bar{c}$ systems with unknown mass splittings. (14 refs.)

117429 $\psi\psi$ production at collider energies. B.Humpert (Inst. de Phys. Nucleaire, Univ. de Lausanne, Lausanne, Switzerland), P.Mery.
Z. Phys. C (Germany), vol.20, no.1, p.83-93 (1983).
The authors estimate $\psi\psi$ production at collider energies in the framework of perturbative QCD. The $O(\alpha_s^2)-O(\alpha_s^4)$ parton cross-sections, with the non-relativistic approximation for the heavy quark bound states, are used. This first insight into the characteristics of the kinematical distributions allows predictions on the predominance of the quark, gluon or B meson production mechanisms in particular kinematical regions. (15 refs.)

Sub-leading contributions to the intrinsic charm of the nucleon ....See Entry 117435

Finite-energy sum rules and light-quark masses ....See Entry 117448

Proton and neutron magnetic moments from QCD sum rules ....See Entry 117466

Jet production and fragmentation ....See Entry 117479

Broken supersymmetric QCD and e^+e^- hadronic cross sections ....See Entry 117483

Quantum chromodynamics and the rise of hadronic total cross sections ....See Entry 117497

Soft-gluon corrections to the Drell-Yan process ....See Entry 117502

Production of vector-meson pairs in hadronic collisions ....See Entry 117504

Proton fragmentation in deep inelastic scattering: a treatment in the valon-recombination model ....See Entry 117505

12.35H Phenomenological composite models of particle structure and reactions (partons, bags, etc.)

117430 An exactly solvable model for fermionic generations and Poincare stresses. W.Krolikowski (Inst. of Theoretical Phys., Warsaw Univ., Warsaw, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.9, p.689-705 (Sept. 1983).
An exactly solvable quantum mechanical model is presented to illustrate the conjecture that leptons and quarks of higher generations may arise as excited states of lepton and quark internal charge distribution kept stable by Poincare stresses. Excitations are then 'quasiphonons' related to internal oscillations around the equilibrium provided by joint action of these stresses and internal electromagnetic forces. The model leads to an exponentially growing mass spectrum proposed previously on the phenomenological ground (predicting toponium at about 40 GeV and the next charged lepton at 28.5 GeV). When perturbed in a natural way, the model is able to describe Cabibbo-like mixing of generations, and, in particular, to predict the off-diagonal elements of Kobayashi-Maskawa matrix. (6 refs.)

117431 Excited quarks and new hadronic states. F.M.Renard (CERN, Geneva, Switzerland).
Nuovo Cimento A (Italy), vol.77A, ser.2, no.1, p.1-20 (1 Sept. 1983).
Develops the phenomenology of excited quarks q*. The author describes the spectroscopy of new $q\bar{q}^*$ mesonic states and calculates the cross-sections of various production mechanisms in e^+e^-, $\gamma\gamma$, lepton-hadron and hadron-hadron collisions. (9 refs.)

117432 A fine- and hyperfine structure analysis of heavy quarkonia: $(b\bar{b})$- and (tt)-states. A.D.Steiger (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Phys. Lett. B (Netherlands), vol.129B, no.5, p.335-40 (29 Sept. 1983).
The fine- and hyperfine structure of (bb)-states is analyzed in a spin-dependent one-parameter potential model. Since this model reproduces the observed masses and leptonic widths of the upsilon family with remarkable accuracy, it is used to predict properties of toponium for a recently suggested t-quark mass of 35 GeV. (17 refs.)

117433 Introduction to the chemistry of fractionally charged atoms: electronegativity. K.S.Lackner, G.Zweig (California Inst. of Technol., Pasadena, CA, USA).
Phys. Rev. D (USA), vol.28, no.7, p.1671-91 (1 Oct. 1983).
The behavior of massive fractionally charged particles in matter is governed by the laws of chemistry if electromagnetic interactions dominate at atomic distances. Chemical properties of such 'quark atoms' can be predicted by interpolating isoelectronic sequences. The properties of quark atoms lie between those of a neutral atom and an ion. Electronegativity helps in the qualitative understanding of quark chemistry. Electronegativities, together with ionzation potentials and electron affinities, are computed for the quark elements. The concepts of chemical analogy and isomorphism are introduced. Analogies based on shell structure and electronegativity are established. Many quark elements cannot be computed to a single ordinary element. They are chemical chimeras. An understanding of quark chemistry is essential for the design and interpretation of quark-search experiments. The impact of chemical reactions on quark impurities in matter can be monitored by observing the behavior of more abundant isomorphic control elements. Contrary to common belief, the chemical differences between a quark element and its ordinary counterpart are substantial. (64 refs.)

117434 Fit of the mixing angles in the six quark model and predictions on the *B* meson lifetime. K.Kleinknecht, B.Renk (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany).
Z. Phys. C (Germany), vol.20, no.1, p.67-70 (1983).
Experimental data are used to constrain the parameters of the six quark mixing model and of a composite quark model. A combined fit of the mixing angles in the Kobayashi-Maskawa scheme gives $\sin\theta_1=0.228\pm0.011$ and error contours around the best values $\sin\theta_2=0.12$ and $\sin\theta_3\approx O$. From this, a limit of $\tau_B>0.35\times10^{-13}s$ for the mean lifetime of bottom-flavoured hadrons is obtained. For the composite quark model of Katsumata and Tomozawa, a value of $\tau_B=(0.22\text{-}0.23)10^{-13}s$ is derived. (17 refs.)

117435 Sub-leading contributions to the intrinsic charm of the nucleon. E.Hoffmann (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany), R.Moore.
Z. Phys. C (Germany), vol.20, no.1, p.71-82 (1983).
The authors discuss corrections to the simple intrinsic charm model due to both quark and nucleon masses via ξ-scaling and mass-dependent radiative QCD contributions, and, in addition, take appropriate account of threshold effects. The recent EMC data are shown not to conflict with the basic idea of intrinsic charm but to suggest that a normalisation of 1% may overestimate the charge content of the nucleon; the large experimental uncertainties in x mean that the simple photon-gluon fusion mechanism alone cannot be ruled out. (18 refs.)

Instability of the mean field vacuum in lattice gauge theories .... See Entry 117317

Infra-red behaviour of the gluon propagator in axial gauges .See Entry 117337

The latent heat of deconfinement in SU(3) Yang-Mills theory .... See Entry 117349

Quarks, partons and quantum chromodynamics .... See Entry 117411

$\psi\psi$ production at collider energies .... See Entry 117429

Parton fragmentation and string dynamics .... See Entry 117441

Relativistic effects in heavy-quarkonium spectroscopy .... See Entry 117458

Corrections to weak structure functions of the nucleon in the region of intermediate values of *x* .... See Entry 117464

Radiative decays of charmonium and constituent quark masses .... See Entry 117467

Calculation of weak neutral currents by the electro-production of pions on nucleons close to the nucleon resonances in the parton-quark model .... See Entry 117474

Multiparticle production in 24, 50 and 400 GeV/c particle-nucleus interactions .... See Entry 117495

Quantum chromodynamics and the rise of hadronic total cross sections .... See Entry 117497

Strange-quark suppression in 225-GeV/*c* π^-Be interactions ..See Entry 117499

Old quark backgrounds in new quark searches .... See Entry 117503

Production of vector-meson pairs in hadronic collisions .... See Entry 117504

12.35K Other composite models

(inc. composite quarks and leptons)

117436 The quark mixing matrix in a composite model. H.Katsumata, Y.Tomozawa (Randall Lab. of Phys., Univ. of Michigan, Ann Arbor, MI, USA).
Ann. Phys. (USA), vol.149, no.2, p.273-85 (Sept. 1983).
The generalized mixing matrix of quarks is computed based on a composite model of quarks and leptons. Among potentials between constituent particles examined $V(r)=Ar^s$ ($As>0$) and A 1n r ($A>0$), it is shown that potentials with exponent $0\lesssim s\lesssim 3$ or in r are consistent with current experimental data for the mixing matrix elements. (12 refs.)

117437 A trouble for composite quark and lepton models?. Z.Y.Zhu (Inst. of Theoretical Phys., Acad. Sinica, Peking, China).
Commun. Theor. Phys. (China), vol.2, no.3, p.1165-8 (1983).
In composite quark and lepton models a factor which depends on the quark or lepton mass ratio appears in the effective weak coupling constant of quarks and leptons. It comes from the Lorentz contraction of the composite quark and lepton wave functions and may cause trouble for their weak coupling constant universality. (2 refs.)

117438 Effects of compositeness in deep inelastic scattering. R.Ruckl (Max-Planck-Inst. fur Phys. und Astrophys., Werner Heisenberg Inst. fur Phys., Munchen, Germany).
Phys. Lett. B (Netherlands), vol.129B, no.5, p.363-9 (29 Sept. 1983).
It is conjectured that leptons and quarks are composites of more fundamental constituents bound together by a new confining force with a typical confinement radius $\sim 1\Lambda_H$. Assuming that the effective low energy lagrangian is given by the lagrangian of the standard model plus induced lepton and quark current-current interactions, the effects of the latter remnants of the new force on the deep inelastic structure function, $F_2(x,Q^2)$, are investigated at $Q^2 \ll \Lambda_H{}^2$. It is shown that these signatures of compositeness should be detectable at HERA if $\Lambda_H \lesssim 2$-3 TeV. (7 refs.)

117439 Understanding of spin $^1/_2$, family structure, and mass pattern of leptons and quarks in a composite model. A.N.Mitra (Dept. of Phys., Univ. of Delhi, Delhi, India).
Phys. Rev. D (USA), vol.28, no.7, p.1745-57 (1 Oct. 1983).
A relativistic three-preon interaction with a spin dependence $\Sigma^a \equiv \sigma_{\mu\nu}{}^{(1)}\sigma_{\nu\lambda}{}^{(2)}\sigma_{\lambda\mu}{}^{(3)}$ is proposed for an SU(2) preon (t,v) model. The Σ^a operator (i) gives zero force for $S={}^3/_2$ states, thus rendering them dynamically irrelevant, and (ii) has the complex combinations $\chi'' \pm i\chi'$ of the two spin-$^2/_2$ functions (χ',χ'') as eigenstates with eigenvalues of opposite signs so that only one combination is relevant for confinement. This feature in turn leads to just three S_3-symmetry classes (out of six available ones) of spatial wave function, again in complex form which are sought to be identified with the generation structures. Their spatial functional forms are such as to obey severe selection rules preventing electromagnetic transitions such as $\mu \rightarrow e\gamma$. Apart from these qualitative features which are shown to remain valid within a fairly general (Bethe-Salpeter-type) dynamical framework, a quantitative model of confinement with a very steep potential ($\sim R^{12}$) is proposed for a unified description of lepton and quark spectra. This leads to a universal (l,q) mass formula for all three generations with only two free parameters, in rather good agreement with the observed pattern. In particular the lepton mass ratios which do not involve any free parameter are predicted as $m_\mu/m_e=196.7$ and $m_\tau/m_\mu=14.3$. (35 refs.)

Evolution condition for electroweak interactions in composite models .... See Entry 117409

Fit of the mixing angles in the six quark model and predictions on the *B* meson lifetime .... See Entry 117434

12.40 MODELS OF STRONG INTERACTIONS

117440 Dual Feynman rules: topological asymptotic freedom. G.F.Chew, M.Levinson (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Z. Phys. C (Germany), vol.20, no.1, p.19-26 (1983).
Feynman-graph rules are formulated for the strong interaction components of the topological expansion, defined as those graphs all of whose vertices are zero entropy connected parts. These rules imply a 'topological asymptotic freedom' and admit a corresponding perturbative evaluation where the zeroth order exhibits topological supersymmetry. (17 refs.)

12.40E Statistical models

117441 Parton fragmentation and string dynamics. B.Andersson, G.Gustafson, G.Ingelman, T.Sjostrand (Dept. of Theoretical Phys., Univ. of Lund, Lund, Sweden).
Phys. Rep. (Netherlands), vol.97, no.2-3, p.31-145 (July 1983).
While much has been learned recently about quark and gluon interactions in the framework of perturbative quantum chromodynamics, the relation between calculated parton properties and observed hadron densities involves models where dynamics and jet empirical rules have to be combined. The authors describe a presently successful approach which is based on a cascade jet model using string dynamics. It can readily lead to Monte Carlo jet programmes of great use when analyzing data. Production processes in an iterative cascade approach, with tunneling in a constant force field are reviewed. Expected differences between quark and gluon jets are discussed. Low transverse momentum phenomena are also reviewed with emphasis on hyperon polarization. (116 refs.)

117442 Jet reconstruction in collider events using digital filtering. A.Donati, R.Odorico (Dipartimento di Fisica, Univ. di Bologna, Bologna, Italy), V.Roberto.
Z. Phys. C (Germany), vol.20, no.1, p.9-18 (1983).
Jet reconstruction in collider events is shown to be made more stable and faster by properly using, in a preliminary stage, information from the energy flow. The latter is processed through a Fourier digital filtering, which removes fluctuations without altering significant dynamical features. Statistical tests are presented indicating good reconstruction efficiency also for complex events. (8 refs.)

Decays of the pseudoscalar mesons .... See Entry 117468

A relativistic version of the statistical model for one meson ..See Entry 117469

12.40H Duality and dual models

117443 Stochastic geometry of O_2 fermionic strings. S.Cecotti (Scuola Normale Superiore, Pisa, Italy).
Nuovo Cimento A (Italy), vol.76A, ser.2, no.4, p.627-44 (21 Aug. 1983).
Studies the O_2 fermionic string with Polyakov's methods. The author shows that the corresponding O_2 super-Liouville theory is equivalent to a classic stochastic system, i.e. possesses a local Nicolai mapping. This property may play a crucial role in the quantization of the model and its integrability. Bosonization gives a very deep insight in the nonperturbative structure of the model: Kosterlitz-Thouless realization of chirality, fractional charges, existence of a free massless field in the spectrum. These phenomena give a great interest to the problem of the supersymmetry fate. The model has some analogies with local supersymmetry (and, indeed, the original Lagrangian is locally supersymmetric); hence, the exotic aspects of the realization of (global) supersymmetry in the O_2 super-Liouville model seem relevant for a dynamical theory of local supersymmetry. (26 refs.)

117444 Classical string phenomenology. How strings work. X.Artru (Lab. de Phys. Theorique et Hautes Energies, Univ. de Paris-Sud, Orsay, France).
Phys. Rep. (Netherlands), vol.97, no.2-3, p.147-71 (July 1983).
The author considers the classical motion of free nonbaryonic (open or closed) strings, and presents the classical rules governing their interactions: cutting, rearrangement and fusion. These rules follow from causality and are given in terms of 'causality diamonds' or subsets of 'genes'. The yo-yo model, which incorporates massless partons in the strings, is also presented and studied. (25 refs.)

117445 Charge distribution in a two-chain dual model. K.Fialkowski (Inst. of Phys., Jagellonian Univ., Cracow, Poland), A.Kotanski.
Z. Phys. C (Germany), vol.20, no.1, p.1-4 (1983).
Charge distributions in the multiple production processes are analysed using the dual chain model. A parametrisation of charge distributions for single dual chains based on the νp and $\bar{\nu}p$ data is proposed. The rapidity charge distributions are then calculated for pp and $\bar{p}p$ collisions and compared with the previous calculations based on the recursive cascade model of single chains. The results differ at the SPS collider energies and in the energy dependence of the net forward charge supplying the useful tests of the dual chain model. (10 refs.)

Self-dual SU_2 Yang-Mills fields in Minkowski space .... See Entry 117333

Parton fragmentation and string dynamics .... See Entry 117441

Reggeized quark multiperipheral model for dual sheets .... See Entry 117447

12.40M Complex angular momentum plane; Regge poles and cuts (Reggeons)

(see also 11.60 for general theory)

Reggeized quark multiperipheral model for dual sheets .... See Entry 117447

The hadron structure functions in the bag model and their modifications .... See Entry 117463

Study of the reactions $\pi^-p \rightarrow \pi^-\Delta^+$ and $\pi^-p \rightarrow \pi^0\Delta^{++}$ at high energies .... See Entry 117487

A study of the reaction $K^-p \rightarrow \phi\Lambda$ at 4.2 GeV/c .... See Entry 117490

A phenomenological investigation of Kp elastic scattering at high energies and small momentum transfers .... See Entry 117491

Study of the reaction $\pi^-p \rightarrow K^*$ (890)Λ/Σ^0 .... See Entry 117492

Study of the reaction $\pi^-p \rightarrow K^0\Lambda^0$ .... See Entry 117493

12.40Q Potential models

117446 An analysis on the color Van der Waals force. Wang Fan (Nanjing Univ., Nanjing, China), He Yin, Zhuang Fei, Jin Xingnan.
Chin. J. Nucl. Phys. (USA), vol.5, no.3, p.263-72 (Aug. 1983). In Chinese.
Up to now approximate methods were used to discuss colour Van der Waals force (VdWf) of the confining potential model. The authors have derived a two-channel (colourless and hidden colour) coupled equation by which the long range nuclear interaction may be determined. By solving the equations they conclude that the r^a type confining potential would yield r^{a-4} type VdWf. But they find that the VdWf is caused by the coupling of highly excited energy levels of the relative motion between two coloured nucleons. Therefore it is possible to eliminate the spurious VdWf by rejecting these highly excited energy levels. They conclude that the confining potential model is still useful to the calculation of the hadron interaction and the dibaryon resonances. (12 refs.)

A fine- and hyperfine structure analysis of heavy quarkonia: $(b\bar{b})$- and $(t\bar{t})$-states .... See Entry 117432

Radiative decays of charmonium and constituent quark masses .... See Entry 117467

12.40R Peripheral models (one or more particle exchange)

117447 Reggeized quark multiperipheral model for dual sheets. T.Kanki (Inst. of Phys., Osaka Univ., Osaka, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.222-8 (July 1983).
Assuming that quarks are reggeized in QCD, the author discusses a quark-multiperipheral model as a possible model of the dual sheet. It is shown that the model reproduces the Lee-Veneziano relation and predicts the interesting result, $\alpha_M(0)-\alpha_B(0)\simeq{}^1/_2$. (9 refs.)

12.40S Multiperipheral and multi-Regge models
(inc. diffraction and diffractive production models)

Diffractive dissociation and the pp multiplicity distribution ...See Entry 117500

12.40V Vector-meson dominance

Production of vector-meson pairs in hadronic collisions ....See Entry 117504

12.70 HADRON MASS FORMULAS

117448 Finite-energy sum rules and light-quark masses. A.L.Kataev, N.V.Krasnikov, A.A.Pivovarov (Inst. for Nuclear Res. of the Acad. of Sci., Moscow, USSR).
Nuovo Cimento A (Italy), vol.76A, ser.2, no.4, p.723-33 (21 Aug. 1983).
The light-quark masses are calculated on the basis of finite-energy sum rules. The result (m_u+m_d(1 GeV)$\simeq$20 MeV) allows one to estimate the ratio $m_b/m_s\sim20$ which should be compared with the prediction of the SU_5 model or grand unification $m_b/m_s=17$. The authors estimate a value of the π'-meson residue and propose a model for the π-meson radial excitation mass spectrum. In particular, they obtain a mass of the second π-meson excitation $m_\pi^2(2)=2m_{\pi'}^2$, in agreement with the experimental data. (26 refs.)

Two-gluino bound states and heavy quarkonium ....See Entry 117427

Radiative decays of charmonium and constituent quark masses ....See Entry 117467

13.00 SPECIFIC REACTIONS AND PHENOMENOLOGY

117449 Current experiments in elementary particle physics. C.G.Wohl, F.E.Armstrong, A.Rittenberg, T.G.Trippe, G.P.Yost, L.Addis, P.Joos, Y.Oyanagi, D.C.Dodder, S.N.Grudtsin, Y.G.Ryabov, R.Frosch, A.Olin.
Report LBL-91 Revised, Univ. California, Lawrence Berkeley Lab., Berkeley, USA (March 1983), 38 pp. Contract DE-AC03-76SF00098.
This report contains summaries of 479 approved experiments in elementary particle physics (experiments that finished taking data before 1 January 1979 are excluded). There are experiments from Brookhaven, CERN, CESR, DESY, Fermilab, Tokyo Institute of Nuclear Studies, KEK, LAMPF, Serpukhov, SIN, SLAC, and TRIUMF, and also experiments on proton decay. Properties of the beams at most of the laboratories are summarized.

13.10 WEAK AND ELECTROMAGNETIC INTERACTIONS OF LEPTONS

117450 Neutral-current effects in the standard and extended gauge models for spin polarization effects in $e^+e^-\to\mu^+\mu^-$. M.Hayashi, K.Katsuura (Dept. of Phys., Saitama Medical Coll., Saitama, Japan), S.Homma.
Nuovo Cimento A (Italy), vol.77A, ser.2, no.1, p.76-98 (1 Sept. 1983).
The authors study various observables (the asymmetry due to the beam polarizations, the forward-backward asymmetry, etc.) in which the neutral-current effects appear in the reaction $e^+e^-\to\mu^+\mu^-$ induced by (longitudinally and transversely) polarized as well as unpolarized e^+e^- beams in combination with the measurements of the longitudinal polarization $P_L(\mu^-)$ of the outgoing muon(s). They carry out the numerical calculation for these quantities at TRISTAN and LEP energies, adopting as examples of the electroweak gauge models the standard Weinberg-Salam model, the ones based on $SU_2\times U_1\times[U_1]'$ and on $SU_2\times U_1\times[SU_2]'$. They argue that at TRISTAN energies the angular distribution of $P_L(\mu^-)$ measurable in the experiment by the polarized beams is especially useful for the purpose of distinguishing between the models. At LEP energy range the measurements of the angular distribution and the energy dependence of $P_L(\mu^-)$ using polarized beams, in addition to the measurement of the total cross-section, can determine the correct model if any. (17 refs.)

117451 Scattering of very light scalar particles, off leptons. B.R.Kim, C.Stamm (Tech. Hochschule Aachen, Aachen, Germany).
Z. Phys. C (Germany), vol.20, no.1, p.53-5 (1983).
Characteristic features of the scattering of light pseudoscalar and scalar particles are pointed out. The authors discuss how a light pseudoscalar particle might experimentally be distinguished from a light scalar particle. Further they give a method for determining the mass of the light pseudoscalar particle. (3 refs.)

Asymmetries in $e^+e^-\to\gamma$, Z_1^0, $Z_2^0\ldots\to\Sigma_q q\bar{q}\to2$ jets due to neutral-current effects in the standard and extended gauge models ....See Entry 117396

Excited quarks and new hadronic states ....See Entry 117431

Angular correlations and the tau-neutrino mass ....See Entry 117462

13.15 NEUTRINO INTERACTIONS
(inc. interactions involving cosmic rays)

117452 On the feasibility of performing neutrino experiments at an intense source of strangeness. R.D.Carlini, G.J.Stephenson (Los Alamos Nat. Lab., Los Alamos, NM, USA).
AIP Conf. Proc. (USA), no.102, p.170-80 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
Several very important low energy neutrino experiments have been identified and discussed by Kayser and Rosen in these proceedings. The authors address the possibility of performing some of these experiments in the environment of a kaon factory. To carry out specific analyses, they draw upon the design of existing BNL detectors, the design of experiments that are proposed for an 800 MeV proton driven facility at Los Alamos, and the use of the code NUBEAM developed at CERN. Since in most cases they have not optimized, this is a conservative estimate. They find that many of the desired experiments can be performed with facilities now under discussion. (7 refs.)

Theoretical Symposium on Intense Medium Energy Sources of Strangeness ....See Entry 116910

Neutrino physics with intense beams ....See Entry 117392

Charge distribution in a two-chain dual model ....See Entry 117445

Proton fragmentation in deep inelastic scattering: a treatment in the valon-recombination model ....See Entry 117505

13.20 LEPTONIC AND SEMILEPTONIC DECAYS OF MESONS

117453 What limits a $K\to\pi\nu\bar{\nu}$ experiment? 2Q. R.E.Mischke (Meson Phys. Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
AIP Conf. Proc. (USA), no.102, p.185-7 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
Experimental limitations regarding the serach for the decay $K\to\pi\nu\bar{\nu}$ are briefly reviewed. (9 refs.)

117454 Lepton mixing and heavy neutrinos. J.-M.Frere (Randall Lab. of Phys., Univ. of Michigan, Ann Arbor, MI, USA).
AIP Conf. Proc. (USA), no.102, p.189-90 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
In view of the considerable interest displayed in experiments looking for $K\to e\nu_x$, $K\to\mu\nu_x$, where ν_x is a hypothetical heavy neutrino mixing with the electronic and/or muonic neutrino, the author comments on a more general (although less sensitive) approach to such mixings. (4 refs.)

117455 Experimental outlook [strangeness energy sources]. B.D.Winstein (Enrico Fermi Inst., Univ. of Chicago , Chicago, IL, USA).
AIP Conf. Proc. (USA), no.102, p.225-34 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
A summary of the prospects for exploiting an intense medium energy source of strangeness is presented, particularly with regard to rare K decays and studies of CP nonconservation. The current status as well as new efforts at the existing laboratories are reviewed for some selected physics topics before possible future initiatives are considered. (35 refs.)

Theoretical Symposium on Intense Medium Energy Sources of Strangeness ....See Entry 116910

Rare kaon processes as a probe of the top quark and gravitino masses on local supersymmetric (SUSY) theories ....See Entry 117381

A fine- and hyperfine structure analysis of heavy quarkonia: ($b\bar{b}$)- and ($t\bar{t}$)-states ....See Entry 117432

Fit of the mixing angles in the six quark model and predictions on the *B* meson lifetime ....See Entry 117434

What limits experiments in rare kaon decays: machines/beam lines or detectors? ....See Entry 117457

Electromagnetic decays of vector and axial mesons $\rho\to\pi+l^++l^-$ and $A_1\to\pi+l^++l^-$ ....See Entry 117470

Observation of baryons in *B*-meson decay ....See Entry 117481

13.25 HADRONIC DECAYS OF MESONS

117456 $K\to\pi$+light pseudoscalar. J.-M.Frere (Randall Lab. of Phys., Univ. of Michigan, Ann Arbor, MI, USA).
AIP Conf. Proc. (USA), no.102, p.155-9 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
The 'classical' or 'standard' axion now looks very dead. The author comments briefly on the present experimental situation, and envisages the sensitivity of the more general decay $K\to\pi$+light pseudoscalar, since such light particles might appear in a considerable number of models or theories (e.g. supersymmetry, technicolor ...). For this purpose, the author considers two cases: (i) the tree-level couplings of the pseudoscalar h is flavor-diagonal (axion-type) (ii) the tree-level coupling is not flavor diagonal (flavor changing neutral current). (5 refs.)

117457 What limits experiments in rare kaon decays: machines/beam lines or detectors?. D.E.Dorfan, F.-W.Sadronzinski (Univ. of California, Santa Cruz, CA, USA), W.C.Louis,III.
AIP Conf. Proc. (USA), no.102, p.181-4 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
The authors discuss the possible experimental limits in the use of higher intensity kaon beams. (no refs.)

117458 Relativistic effects in heavy-quarkonium spectroscopy. R.McClary, N.Byers (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Phys. Rev. D (USA), vol.28, no.7, p.1692-705 (1 Oct. 1983).
It is shown that the discrepancy between the measured rate for $\psi'\to\chi_0\gamma$ and that predicted by nonrelativistic models can be accounted for by $(v/c)^2$ relativistic corrections. A Breit-Fermi Hamiltonian is used to predict the energy level structure and $E1$ transition rates in the charmonium and Υ systems. It is obtained from an instaneous approximation to a Bethe-Salpeter equation whose kernel is composed of Coulomb-gauge gluon exchange and a scalar confining piece. The model accounts for the observed fine and hyperfine structure of the charmonium levels and for the $E1$ transition rates. It is used to predict the level structure and $E1$ rates in the Υ system. it is shown that an extension of Siegert's theorem is valid in the relativistic regime. This result is useful in analyzing $E1$ transition-matrix elements. (21 refs.)

Theoretical Symposium on Intense Medium Energy Sources of Strangeness ....See Entry 116910

CP violation in $K\to3\pi$ decays ....See Entry 117376

Rare K and μ decays: theoretical and experimental status and prospects ....See Entry 117390

A lower bound on $|\epsilon'/\epsilon|$ ....See Entry 117420

Experimental outlook [strangeness energy sources] ....See Entry 117455

Strange-quark suppression in 225-GeV/*c* π^-Be interactions ..See Entry 117499

13.30 DECAYS OF BARYONS

117459 Electromagnetic corrections to semileptonic decays with a polarized emitted hyperon. A.Garcia (Dept. de Fisica, Inst. Politecnico Nacional, Mexico City, Mexico).
Phys. Rev. D (USA), vol.28, no.7, p.1659-63 (1 Oct. 1983).
The radiative corrections to the Dalitz plot of hyperon semileptonic decays when the recoil hyperon is polarized are studied. An expression for the transition probability that is suitable for high statistics experimental analysis is obtained. The model-dependent part of the radiative corrections is retained in general so that the results obtained are not limited to specific model calculations. The asymmetry coefficients are dealt with in the second part of this paper. (13 refs.)

117460 Further experimental test of nucleon charge conservation through the reaction ^{13}Cd$\rightarrow$^{113m}In+neutrals. A.Roy, S.C.Vaidya, D.C.Ephraim, V.M.Datar, K.S.Bhatki, S.K.Bhattacherjee (Tata Inst. of Fundamental Res., Bombay, India).
Phys. Rev. D (USA), vol.28, no.7, p.1770-2 (1 Oct. 1983).
A new experiment to search for the charge-nonconserving decay of a nucleon through the decay ^{113}Cd$\rightarrow$^{113m}In+neutrals has been performed employing the coincidence-detection technique between the *K*-conversion electrons and the *K* X-rays in ^{113m}In separated chemically from a bulk sample of $CdCl_2$. The measurement yields a lower limit on the mean life $\tau_N{}^{CNC} \geq 1.4 \times 10^{18}$ yr. (10 refs.)

Hyperron decays and a limit on left-right mixing ....See Entry 117391

13.35 DECAYS OF LEPTONS

117461 Two-photon decays of heavy neutrinos. J.F.Nieves (Dept. of Phys., Univ. of Puerto Rico, Rio Piedras, Puerto Rico).
Phys. Rev. D (USA), vol.28, no.7, p.1664-70 (1 Oct. 1983).
The process $\nu_1 \rightarrow \nu_2 + \gamma + \gamma$ is studied in detail. Formulas for the decay rate are given in the context of the SU(2)×U(1) model with massive neutrinos and it is shown that this process can dominate over $\nu_1 \rightarrow \nu_2 + \gamma$ for some range of values of $m_{\nu 1}$, depending on the relevant mixing angles. A general, model-independent analysis is also given with particular emphasis on the difference between the cases of Dirac and Majorana neutrinos. In particular, the author shows how the invariant amplitudes in the Majorana case can be expressed in terms of the amplitudes calculated as if the neutrinos were Dirac particles. (21 refs.)

117462 Angular correlations and the tau-neutrino mass. J.Babson, E.Ma (Dept. of Phys. & Astron., Univ. of Hawaii, Honolulu, HI, USA).
Z. Phys. C (Germany), vol.20, no.1, p.5-7 (1983).
Effects of a nonzero mass for the tau neutrino ν_τ as well as a right-handed charged-current contribution to the τ-ν_τ coupling are discussed. Angular correlations of the decay products of $\tau^+\tau^-$ in e^+e^- annihilation are calculated as functions of $m(\nu_\tau)$ and the relative amount of right-handed τ-ν_t coupling. (11 refs.)

Rare K and μ decays: theoretical and experimental status and prospects ....See Entry 117390

13.40 ELECTROMAGNETIC PROCESSES AND PROPERTIES

13.40F Electromagnetic form factors; electric and magnetic moments

117463 The hadron structure functions in the bag model and their modifications. Wang Xing-Min, Song Xiao-Tong (Dept. of Phys., Hangzhou Univ., Hangzhou, Zhejiang, China), Yin Peng-Cheng.
Hadronic J. (USA), vol.6, no.4, p.985-1010 (July 1983).
The authors calculate the structure functions of nucleons and mesons by using translation-invariant bag-quarks effective currents and an assumption of freedom-separation rules. The 4-momentum conservation is satisfied automatically in the authors' calculation, while the resultant structure functions have explicit Bjorken scaling, positive-definiteness and a suitable asymptotic behavior. A new counting rule is also obtained. Then Regge-correction terms are introduced to modify the valence quark distribution functions. The obtained functions seem to be in good agreement with the experimental curves. Finally, the seaquark distribution functions are calculated by use of Pomeron-correction terms, which, when the new counting rule is applied, seem to be well consistent with the data. (15 refs.)

117464 Corrections to weak structure functions of the nucleon in the region of intermediate values of *x*. J.Abad (Dept. de Fisica Teorica, Univ. de Zaragoza, Zaragoza, Spain).
Nuovo Cimento A (Italy), vol.77A, ser.2, no.2, p.184-96 (21 Sept. 1983).
The corrections of order $1/Q^2$ are calculated in the large-middle *x*-value region, by using a type of diagram that is assumed dominant in this region. The author shows the behaviour of these corrections and that these corrections fulfil the Callan-Gross relation $W_2 = (4x^2M^2/Q\mathrm{R}^2)W_1$ and the relation $W_2 = \xi W_3$. (6 refs.)

117465 Precision measurement of the magnetic moment of the Σ^- hyperon. D.W.Hertzog, M.Eckhause, K.L.Giovanetti, R.J.Kane, W.C.Phillips, W.F.Vulcan, R.E.Welsh, R.J.Whyley, R.G.Winter (Coll. of William & Mary, Williamsburg, VA, USA), G.W.Dodson, J.P.Miller, F.O'Brien, B.L.Roberts, D.R.Tieger, R.J.Powers, N.J.Colella, R.B.Sutton.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1131-4 (26 Sept. 1983).
The magnetic moment of the Σ^- hyperon has been obtained from measurements of fine-structure splittings of X-ray transitions in Σ^- exotic atoms. The use of targets consisting of sheets of Pb or W immersed in liquid hydrogen, and of a tagging technique utilizing the π^+ emitted in the reaction $K^-p \rightarrow \Sigma^-\pi^+$, resulted in improved X-ray signal-to-noise ratio by a factor of 15 over that in previous experiments. The present result is $\mu(\Sigma^-) = (1.111 \pm 0.031 \pm 0.011)\mu_N$. (17 refs.)

117466 Proton and neutron magnetic moments from QCD sum rules. I.I.Balitsky, A.V.Yung (Leningrad Nuclear Phys. Inst., Leningrad, USSR).
Phys. Lett. B (Netherlands), vol.129B, no.5, p.328-34 (29 Sept. 1983).
The proton and neutron magnetic moments are calculated within QCD using sum rules with bilocal power corrections accounted for. (20 refs.)

CP-violation through Higgs exchange ....See Entry 117387

Evolution condition for electroweak interactions in composite models ....See Entry 117409

Dimensionally regularized two-loop on-shell quark form factor ....See Entry 117425

Effects of compositeness in deep inelastic scattering ....See Entry 117438

New measurement of deep-inelastic *e-p* asymmetries ....See Entry 117473

13.40H Electromagnetic decays

117467 Radiative decays of charmonium and constituent quark masses. Kuang-Ta Chao (Dept. of Phys., Peking Univ., Peking, China).
Commun. Theor. Phys. (China), vol.2, no.3, p.1129-35 (1983).
The problems of both E1 and M1 transitions of charmonium are discussed in the nonrelativistic potential model. It is found these that problems could be resolved by assuming larger constituent quark masses. With $m_c = 2.50$ GeV, $m_b = 5.84$ GeV in the typical linear plus Coulomb potential model the author gets satisfactory results for the mass spectra, the E1 and M1 transition rates, and the relative values of leptonic widths for the ψ and Υ families. The implication of the large constituent quark masses is also discussed. (10 refs.)

117468 Decays of the pseudoscalar mesons. S.N.Banerjee, R.K.Das (Dept. of Phys., Jadavpur Univ., Calcutta, India).
Hadronic J. (USA), vol.6, no.4, p.956-70 (July 1983).
Electromagnetic and hadronic decay widths of the pseudoscalar mesons have been investigated with the pion wavefunction as input from the statistical model, into the usual Van Royen-Weisskopf formula and its modified version. For the $\eta \rightarrow \gamma\gamma$ decay, the authors' computed results for the electromagnetic decay widths for $\pi^0 \rightarrow \gamma\gamma$ and $\eta' \rightarrow \gamma\gamma$ processes compare favourably with the corresponding experimental findings and the hadronic decay widths agree reasonably well with the only existing theoretical estimates. (13 refs.)

117469 A relativistic version of the statistical model for one meson. S.N.Banerjee, R.Saha (Dept. of Phys., Jadavpur Univ., Calcutta, India).
Hadronic J. (USA), vol.6, no.4, p.971-84 (July 1983).
A relativistic version of the statistical model of one meson has been developed, which yields an analytical form of the square modulus of the mesonic wavefunction. In the massless quark limit, it assumes an extremely simple form. Using this form as an input, the pionic decay constant and the decay width for the $\pi^0 \rightarrow 2\gamma$ process have been calculated. Close agreement with the corresponding experimental findings has been achieved. (13 refs.)

117470 Electromagnetic decays of vector and axial mesons $\rho \rightarrow \pi + l^+ + l^-$ and $A_1 \rightarrow \pi + l^+ + l^-$. M.P.Rekalo.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1308-13 (Sept. 1983). In Russian.
The angular and energy distributions of radiative decay products have been studied for decays of vector and axial mesons, $V \rightarrow \pi + l^+ + l^-$ and $A \rightarrow \pi + l^+ + l^-$, taking into account one-spin particle polarization. P-odd effects in $V \rightarrow \pi + l^+ + l^-$ decays, when *P*-invariance is violated in the electromagnetic vertex $V \rightarrow \pi + \gamma$ must be essentially intensified in the kinematic region where a virtual γ-quantum 3-impulse is small. The methods of differentiation of the *P*-noninvariance mechanism in pi-meson production and the *P*-noninvariance mechanism in the V-meson decays are discussed. (11 refs.)

117471 Search for light penetrating bosons with the use of a rotatable detector arrangement at a nuclear reactor. H.R.Kock, O.W.B.Schult, H.Seyfarth (Inst. fur Kernphys., KFA Julich, Julich, Germany), H.Bechteler, R.Yogeshwar.
Z. Phys. A (Germany), vol.313, no.3, p.239-40 (1983).
The search for the two-photon decay of light penetrating bosons (axions or others), produced in a nuclear reactor, was supplemented by measurements with a rotatable set-up at the Julich 10 MW research reactor FRJ-1. Measurements were performed in 'effect' and 'background' positions, the latter not allowing the simultaneous detection of both photons due to decay kinematics. Preliminary measurements, carried out at reactor ON condition only, show no positive effect. (8 refs.)

Two-photon decays of heavy neutrinos ....See Entry 117461

13.40K Electromagnetic corrections to strong and weak interaction processes

Strong radiative corrections to strangeness-changing processes in the presence of right-handed currents ....See Entry 117383

Sub-leading contributions to the intrinsic charm of the nucleon ....See Entry 117435

Electromagnetic corrections to semileptonic decays with a polarized emitted hyperon ....See Entry 117459

Corrections to weak structure functions of the nucleon in the region of intermediate values of *x* ....See Entry 117464

13.60 PHOTON AND CHARGED-LEPTON INTERACTIONS WITH HADRONS

(for neutrino interactions, see 13.15)

117472 Leptoquark production at HERA. S.Chadha, J.Proudfoot, D.H.Saxon.
Report RL-83-071, Rutherford Appleton Lab., Chilton, Oxon., England (Aug. 1983), 40 pp.
Considers the production and properties of the leptoquark states, (predicted by technicolour theories) at the HERA ep colliding-beam facility. It is found that useful event signatures can be obtained and that, using a reasonable charged-current detector, mass peaks can be reconstructed. For likely event rates, sufficient background suppression is obtained to permit observation of these states. (13 refs.)

Excited quarks and new hadronic states ....See Entry 117431

Jet production and fragmentation ....See Entry 117479

13.60F Elastic and Compton scattering

117473 New measurement of deep-inelastic *e-p* asymmetries. G.Baum, M.R.Bergstrom, P.R.Bolton, J.E.Clendenin, N.R.DeBotton, S.K.Dhawan, Y.-N.Guo, V.-R.Harsh, V.W.Hughes, M.S.Lubell, Z.-L.Mao, R.H.Miller, S.Miyashita, K.Morimoto, U.F.Moser, I.Nakano, R.F.Oppenheim, D.A.Palmer, L.Panda, W.Raith, N.Sasao, K.P.Schuler, M.L.Seely, P.A.Souder, S.J.St. Lorant, K.Takikawa, M.Werlen (Inst. of High Energy Phys., Beijing, China).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1135-8 (26 Sept. 1983).
Spin-dependent asymmetries have been measured in inclusive deep-inelastic scattering of longitudinally polarized electrons by longitudinally polarized protons. Data were obtained at a scattering angle of 10° and for incident energies of 16.2 and 22.7 GeV, which cover the kinematic range $0.18 < x < 0.70$ and $3.5 < Q^2 < 10.0$ $(\mathrm{GeV}/c)^2$. The present results provide a test of scaling and

of the Bjorken and Ellis-Jaffe sum rules and are compared with various models of proton spin structure. (27 refs.)

13.60K Meson production

117474 Calculation of weak neutral currents by the electro-production of pions on nucleons close to the nucleon resonances in the parton-quark model. F.S.Sadykhov, K.A.Petrosyan, R.I.Mikailov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.1, p.99-104 (1983). In Russian.
Considers the process of the electroproduction of pions on nucleons close to the nucleon resonance range taking into account weak neutral currents in the parton-quark model. Using the angular distribution and the dependence of the cross section on the transmission of momentum constants of quark and gluon interactions, the contribution of weak neutral currents to the degree of polarization has been obtained. (11 refs.)

117475 Direct electromagnetic excitation $N \rightarrow \Delta(1232)$, final-state interactions, and the multipoles $M_{1+}^{(3/2)}$ and $E_{1+}^{(3/2)}$ of photopion production of nucleons in the range $160 \lesssim E_\gamma \lesssim 800$ MeV. A.Jurewicz (Istituto di Fisica 'G. Marconi', Univ. Degli Studi, Roma, Italy).
Phys. Rev. D (USA), vol.28, no.7, p.1604-17 (1 Oct. 1983).
In this paper one of the classics of particle theory in the resonance region is reexamined, namely the prediction of the amplitudes $M_{1+}^{(3/2)}$ and $E_{1+}^{(3/2)}$ of photopion production on nucleons around the resonance $\Delta(1232)$. The tool employed for this purpose is the final-state-interaction theory, and the principal aim of the study is to advocate for the appearance of two distinct dynamical mechanisms of photoexcitation in such an approach. Special emphasis is put on the naturally emerging links between the present treatment and the isobaric approach and calculations based on the static quark model. It is argued that the dynamical meaning of the troublesome arbitrary constants can be very convincingly explained when the resonances formed in the reaction [$\Delta(1232)$ in this specific case] are treated as 'elementary' objects represented in the T-matrix elements by singularities of the Castillejo-Dalitz-Dyson kind. In the case discussed here, 'direct' magnetic-dipole excitation $N \rightarrow \Delta(1232)$ seems to emerge very clearly as an independent dynamical mechanism of photoproduction in the p_{33} state, parallel to the usual electromagnetic excitation of nonresonant πN systems, both followed by resonant pion-nucleon rescattering. It turns out that the magnitude of such direct $\gamma N \Delta$ coupling is completely determined by the related strong interactions. The necessity of allowing for both specified mechanisms in this and other similar calculations is emphasized. (44 refs.)

13.60P Baryon and baryon resonance production

117476 Deuteron photodisintegration. I. Theory and results at low energies. W.-Y.P.Hwang, J.T.Londergan, G.E.Walker (Dept. of Phys., Indiana Univ., Bloomington, IN, USA).
Ann. Phys. (USA), vol.149, no.2, p.335-73 (Sept. 1983).
The authors extend the 'elementary-particle treatment' of deuteron electrodisintegration at small excitation energies, as developed by Hwang, Henlen, and Miller (1981), by incorporating more (np)-scattering states so that dueteron disintegration by low-energy photons can also be investigated. The nucleon-only impulse approximation (NOIA), as modified to incorporate gauge invariance (GI), is assumed to be valid only in the Breit frame, in which the initial and final nuclear systems are treated symmetrically. The matrix element of the electromagnetic current is thus determined in the Breit frame and then transformed into the CM frame. In addition, the difference between the resultant NOIA/GI and the NOIA is determined explicitly in every channel. Numerical results are obtained for the Reid soft-core potential with extensions required for $J>2$ scattering states. It is found that there is no substantial discrepancy between the $\theta_p=0°$ data of Hughes et al. (1976) and the prediction of this formalism. General features of this formalism, including angular distributions at low energies, are discussed in quantitative terms. (32 refs.)

117477 The general structure of polarization characteristics in deuteron electrodsintegration. M.P.Rekalo, G.I.Gakh, A.P.Rekalo.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1313-18 (Sept. 1983). In Russian.
The differential cross-section of the deuteron electrodisintegration $e^- + d \rightarrow e^- + n + p$ (with the detection of two final particles) is found to depend on the polarization states of colliding particles. The general case of deuteron vector and tensor polarizations has been considered. The dependence of all symmetries of the angular proton distributions in $e^- + d \rightarrow e^- + n + p$ (caused by electron and deuteron polarizations) on two kinematic variables (azimuthal angle ϕ and parameter κ—the degree of virtual photon linear polarization) has been predicted taking into account the hadron electromagnetic current conservation and P-invariance of the hadron electromagnetic interactions. The general structure of the proton polarization in the $e^- + d \rightarrow e^- + n + p$ reaction has been found. (14 refs.)

Direct electromagnetic excitation $N \rightarrow \Delta(1232)$, final-state interactions, and the multipoles $M_{1+}^{(3/2)}$ and $E_{1+}^{(3/2)}$ of photopion production of nucleons in the range $160 \lesssim E_\gamma \lesssim 800$ MeV ....See Entry 117475

13.65 HADRON PRODUCTION BY ELECTRON-POSITRON COLLISIONS

117478 A measurement of $e^+e^- \rightarrow \bar{p}p$ for $(1975 \leq \sqrt{s} \leq 2250)$ MeV. D.Bisello, S.Limentani, M.Nigro, L.Pescara, M.Posocco, P.Sartori (Istituto di Fisica, Univ. Padova, Padova, Italy), J.E.Augustin, G.Busetto, G.Cosme, F.Couchot, B.Dudelzak, P.Eschstruth, F.Fulda, B.Grelaud, G.Grosdidier, B.Jean-Marie, S.Jullian, D.Lalanne, V.Lepeltier, C.Paulot, R.Riskalla, P.Roy, F.Rumpf, L.Stanco, G.Szklarz, R.Baldini, G.Capon.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.3, p.379-95 (19 Sept. 1983).
The $e^+e^- \rightarrow \bar{p}p$ cross section has been measured in the energy interval $(1975 \leq 2E \leq 2250)$ MeV for $|\cos\theta| < 0.7$. The measurement is based on ~100 events, thus improving by a factor 3 on the previous existing statistics in this energy interval. The form factor $|G|^2$ is given as a function of energy under the assumption $|G_E| = |G_M|$. The authors also give the first measurement of the differential cross section, averaged over the energy interval, and estimate the ratio $|G_M|/|G_E|$ from it. (16 refs.)

117479 Jet production and fragmentation. G.Wolf (DESY, Hamburg, Germany).
Hadronic J. (USA), vol.6, no.4, p.853-934 (July 1983).
Jets produced by hard constituent scattering are clearly observed in e^+e^- annihilation, deep inelastic lepton nucleon scattering and large p_T hadron hadron scattering. Amongst the most exciting results are the direct measurement of the parton-parton scattering angular distribution and the observation of very energetic jets at the SPS collider. QCD provides a consistent description for the underlying constituent scattering processes. The particle composition observed indicate similar fragmentation properties of quarks and gluons in e^+e^- annihilation and lepton nucleon scattering. (94 refs.)

117480 Production of charmed mesons in e^+e^- annihilation at 10.5 GeV. P.Avery, C.Bebek, K.Berkelman, D.G.Cassel, J.W.DeWire, R.Ehrlich, T.Ferguson, R.Galik, M.G.D.Gilchriese, B.Gittelman, M.Halling, D.L.Hartill, .Herrup,D., S.Holzner, M.Ito, J.Kandaswamy, V.Kistiakowsky, D.L.Kreinick, Y.Kubota, N.B.Mistry, E.Nordberg, M.Ogg, R.Perchonok, R.Plunkett, A.Silverman, P.C.Stein, S.Stone, D.Weber, R.Wilcke (Cornell Univ., Ithaca, NY, USA), A.J.Sadoff, R.Giles, J.Hassard, M.Hempstead, K.Kinoshita, W.W.MacKay, F.M.Pipkin, R.Wilson, T.Jensen, H.Kagan, S.Behrends, K.Chadwick, J.Chauveau, P.Ganci, T.Gentile, J.M.Guida, J.A.Guida, R.Kass, A.C.Melissinos, S.L.Olsen, G.Parkhurst, D.Peterson, R.Poling, C.Rosenfeld, G.Rucinski, E.H.Thorndike, P.Tipton, J.Green, R.G.Hicks, F.Sannes, P.Skubic, A.Snyder, R.Stone, A.Chen, M.Goldberg, N.Horwitz, A.Jawahery, P.Lipari, G.C.Moneti, C.G.Trahern, H.Van Hecke, M.S.Alam, S.E.Csorna, L.Garren, M.D.Mestayer, R.S.Panvini, Xia Yi.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1139-42 (26 Sept. 1983).
A measurement is presented of the inclusive production of charged D^* and neutral D mesons from nonresonant e^+e^- annihilation in the energy region near the $\Upsilon(4S)$ resonance. The momentum distribution shows a large contribution at high momenta as expected for heavy quark production. Comparison of the spectrum with several phenomenological models is made. The relative yields of the D^* and D mesons indicate that the charm cross section is dominated by the D^* contribution. (12 refs.)

117481 Observation of baryons in *B*-meson decay. M.S.Alam, S.E.Csorna, L.Garren, M.D.Mestayer, R.S.Panvini, Xia Yi (Vanderbilt Univ., Nashville, TN, USA), Giles R., J.Hassard, M.Hempstead, K.Kinoshita, W.W.MacKay, F.M.Pipkin, R.Wilson, H.Kagan, P.Avery, C.Bebek, K.Berkelman, D.G.Cassel, J.W.DeWire, R.Ehrlich, T.Ferguson, R.Galik, M.G.D.Gilchriese, B.Gittelman, M.Halling, D.L.Hartill, D.Herrup, S.Holzner, M.Ito, J.Kandaswamy, V.Kistiakowsky, D.L.Kreinick, Y.Kubota, N.B.Mistry, F.Morrow, E.Nordberg, M.Ogg, R.Perchonok, R.Plunkett, A.Silverman, P.C.Stein, S.Stone, D.Weber, R.Wilcke, A.J.Sadoff, S.Behrends, K.Chadwick, J.Chauveau, P.Canci, T.Gentile, J.M.Guida, J.A.Guida, R.Kass, A.C.Melissinos, S.L.Olsen, G.Parkhurst, D.Peterson, R.Poling, C.Rosenfeld, G.Rucinski, E.H.Thorndike, P.Tipton, J.Green, R.G.Hicks, F.Sannes, P.Skubic, A.Snyder, R.Stone, A.Chen, M.Goldberg, N.Horwitz, A.Jawahery, P.Lipari, G.C.Moneti, C.G.Trahern, H.van Hecke.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1143-6 (26 Sept. 1983).
In a sample of B mesons from the decay of the $\Upsilon(4S)$ produced in e^+e^- collisions at the Cornell Electron Storage Ring, inclusive protons, antiprotons, lambdas, and antilambdas have been observed. Lower limits to the B-to-baryon branching ratios are derived. (14 refs.)

117482 Inclusive D and D^* production in e^+e^- annihilation at 29 GeV. S.Ahlen, C.Akerlof, G.Baranko, P.Baringer, I.Beltrami, D.Bender, D.Blockus, B.Brabson, J.Chapman, Y.Cho, S.T.Chui, B.Cork, R.DeBonte, M.Derrick, S.Ems, D.Errede, E.Fernandez, G.E.Forden, R.Fries, K.K.Gan, G.Gieraltowski, S.W.Gray, J.-P.Guillaud, N.Harnew, L.Hyman, K.Jaeger, L.Keller, P.Kesten, R.Klem, D.Koltick, P.Kooijman, S.Kooijman, F.Loeffler, J.S.Loos, F.LoPinto, U.Mallik, R.McIlwain, D.I.Meyer, D.H.Miller, B.Musgrave, H.Neal, C.R.Ng, D.Nitz, H.Ogren, P.P.Ong, L.E.Price, L.K.Rangan, D.Rubin, D.Rust, J.Schlereth, P.Schreiner, A.A.Seidl, E.I.Shibata, R.Singer, P.Smith, R.Stevens, R.Thun, T.Trinko, M.Valdata-Nappi, J.Va'vra, L.T.Wang, C.Ward, J.M.Weiss, M.Willutzky, R.J.Wilson, D.E.Wood (Argonne Nat. Lab., Argonne, IL, USA).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1147-50 (26 Sept. 1983).
Inclusive production of $(D^0, \bar{D}^0)$ and $D^\pm$ mesons have been observed in e^+e^- annihilation at 29 GeV. The signals correspond to R values of $R(D^0+\bar{D}^0)=3.25 \pm 1.2$ and $R(D^+ + D^-)=1.35 \pm 0.6$. $D^{*\pm}$ production is also observed via the process $D^{*+} \rightarrow D^0\pi^+$ and its charge conjugate. The D and D^* production rates are compared. (15 refs.)

117483 Broken supersymmetric QCD and e^+e^- hadronic cross sections. G.Altarelli, B.Mele (Dipartimento di Fisica, Univ. 'La Sapienza', Rome, Italy), R.Petronzio.
Phys. Lett. B (Netherlands), vol.129B, no.6, p.456-60 (6 Oct. 1983).
Effects of broken supersymmetry on some exclusive and the total inclusive e^+e^- hadronic cross sections are studied. In particular, the first-order QCD correction to $R_{e^+e^-}$ from s-quark and gluino effects is computed and discussed with particular emphasis on the energy interval below the threshold for production of a pair of s-quarks and on the limit of infinite energies. (10 refs.)

Asymmetries in $e^+e^- \rightarrow \gamma, Z_1^0, Z_2^0 \ldots \rightarrow \Sigma_q q\bar{q} \rightarrow 2$ jets due to neutral-current effects in the standard and extended gauge models ....See Entry 117396

Excited quarks and new hadronic states ....See Entry 117431

13.75 HADRON-INDUCED LOW- AND INTERMEDIATE-ENERGY REACTIONS AND SCATTERING, ENERGY ≤ 10 GEV

(for higher energies, see 13.85)

13.75C Nucleon-nucleon interactions, including antinucleon, deuteron, etc. (energy ≤ 10 GeV)

(for N-N interactions in nuclei, see 21.30)

117484 Parametrisation of hadron inclusive cross sections in p-p collisions extended to very low energies. L.C.Tan, L.K.Ng (Phys. Dept., Univ. of Hong Kong, Hong Kong).
J. Phys. G (GB), vol.9, no.10, p.1289-308 (Oct. 1983).
To parametrise the inclusive differential cross sections of charged hadrons produced in p-p collisions at the CMS energy, $\sqrt{s} \lesssim 10$ GeV, where the radial-scaling limit is not reached, a new variable $x_T = T^*/T^*_{max}$ is introduced, where T^* is the kinetic energy of a hadron produced in the CMS. The ratio of the low-energy inclusive differential cross section to that of its corresponding radial-scaling limit is found to be explicitly independent of p_t and approaches unity monotonically and quickly from above for increasing $\sqrt{s}$. The authors have succeeded in parametrising the inclusive differential cross sections for hadrons including $\pi^\pm$, $\kappa^\pm$, p and $\bar{p}$, and the expressions obtained are applicable at energies from the ISR down to those near the production thresholds. (35 refs.)

117485 Dibaryon resonance and aligned coupling states of nucleon and Δ isobar. T.Otofuji, K.Sakai (Dept. of Phys., Nagoya Univ., Nagoya, Japan), H.Kanada, S.Saito, M.Yasuno.
Prog. Theor. Phys. (Japan), vol.70, no.1, p.322-5 (July 1983).
The resonance-like behaviors observed in the NN scattering are investigated with the channel coupling between NN and NΔ. The dominant role of the aligned coupling states of the NΔ system is made clear. It is essential to give rise to the resonancelike behaviors that the intermediate NΔ state is unstable and have large inelasticity. (11 refs.)

117486 Extension of the soft-photon theorem for bremsstrahlung. G.E.Bohannon (Carnegie Software, Redondo Beach, CA, USA), L.Heller.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1151-4 (26 Sept. 1983).
A correction to the soft-photon theorem for bremsstrahlung is derived for problems in which the strong interaction is known at large distances. In studies of a model problem the correction generally results in significant improvement in accuracy over the original theorem. (9 refs.)

Charge distribution in a two-chain dual model ....See Entry 117445

13.75G Pion-baryon interactions (energy ≤ 10 GeV)

117487 Study of the reactions $\pi^- p \to \pi^- \Delta^+$ and $\pi^- p \to \pi^0 \Delta^{++}$ at high energies. Fazal-e-Aleem, M.Saleem (Dept. of Phys., Punjab Univ., Lahore, Pakistan), I.E.Qureshi.
Hadronic J. (USA), vol.6, no.4, p.1040-7 (July 1983).
The differential cross section for the reaction $\pi^- p \to \pi^0 \Delta^+$, including the recent results for large angle cross sections at 5 GeV/c have been fitted by using the simple Regge pole model with phenomenological residue functions. The SU(2) invariance at the vertices has been used to determine $^{d\sigma}/_{dt}$ for the process $\pi^- p \to \pi^0 \Delta^{++}$. (7 refs.)

117488 Measurement of low-energy elastic $\pi^\pm p$ differential cross sections. J.S.Frank, A.A.Browman, P.A.M.Gram, R.H.Heffner, K.A.Klare, R.E.Mischke, D.C.Moir, D.E.Nagle, J.M.Potter, R.P.Redwine, M.A.Yates (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Phys. Rev. D (USA), vol.28, no.7, p.1569-85 (1 Oct. 1983).
The authors have measured differential cross sections for both $\pi^+ p$ and $\pi^- p$ elastic scattering at incident-pion kinetic energies of 30, 50, 70, and 90 MeV in the center-of-mass angular range between 50° and 150°. The experiment detected pions scattered from a liquid-hydrogen target with multiwire proportional chambers and scintillation-counter range telescopes. The relative accuracy of each angular distribution is better than 5%, while the absolute cross sections have uncertainties of 4% to 25%. The results for the absolute cross section for $\pi^+ p$ scattering at 30 and 90 MeV are inconsistent with previous measurements. The $\pi^- p$ measurements comprise the first extensive set of precision differential cross sections below 90 MeV. (10 refs.)

117489 Study of π-π scattering amplitudes in the reaction $\pi^+ p \to \Delta^{++} \pi^0 \pi^0$ at 8.0 GeV. N.M.Cason, P.E.Cannata, A.E.Baumbaugh, J.M.Bishop, N.N.Biswas, L.J.Dauwe, V.P.Kenney, R.C.Ruchti, W.D.Shephard (Univ. of Notre Dame, Notre Dame, IN, USA), J.M.Watson.
Phys. Rev. D (USA), vol.28, no.7, p.1586-600 (1 Oct. 1983).
An experiment studying the reaction $\pi^+ p \to \Delta^{++} \pi^0 \pi^0$ using the Argonne National Laboratory 1.5-m streamer chamber combined with a lead-glass hodoscope is described. The data were analyzed in terms of $\pi^+ \pi^- \to \pi^0 \pi^0$ scattering, and the details of the extrapolation to the pole are discussed. An energy-independent amplitude analysis from threshold to 2.3 GeV is presented. In this analysis the $f^0(1270)$, the $h^0(2040)$, and a $J^P = 2^+$ state at 1.8 GeV with a width of 0.280 GeV are observed. The amplitude ambiguity arising from analyses of $\pi^+ \pi^- \to \pi^+ \pi^-$ data in the 1.6 GeV region is resolved. An energy-dependent phase-shift analysis from 1.0 to 1.5 GeV is presented. (36 refs.)

Study of the reaction $\pi^- p \to K^0 \Lambda^0$ ....See Entry 117493

13.75J Kaon-baryon interactions (energy ≤ 10 GeV)

117490 A study of the reaction $K^- p \to \phi \Lambda$ at 4.2 GeV/c. M.Kamran (Phys. Dept., Punjab Univ., Lahore, Pakistan).
Commun. Theor. Phys. (China), vol.2, no.3, p.1121-7 (1983).
The high statistics differential cross-section, polarisation and density matrix data on $K^- p \to \phi \Lambda$ obtained by the Amsterdam-CERN-Nijmegen-Oxford collaboration at 4.2 GeV/c is analysed using a Regge pole model with evasive Regge contributions. The exchanges invoked are the K^*, K^{**}, K,K_A and K_Z. The K^*-K^{**} exchanges are taken to be non-degenerate and a simplifying assumption on their couplings in $0+{}^1/_2 \to O+{}^1/_2$ reactions, advocated recently by Saleem and collaborators (1980, 1981), is generalised to the present case. The author did not find any need for the K_B in fitting data. (14 refs.)

117491 A phenomenological investigation of Kp elastic scattering at high energies and small momentum transfers. M.Kamran (Dept. of Phys., Punjab Univ., Lahore, Pakistan).
Hadronic J. (USA), vol.6, no.4, p.1011-28 (July 1983).
A phenomenological study of Kp elastic $d\sigma/dt$ and polarisation data for $p_{lab} \geq 10$ GeV/c and $|t| \leq 1$ $(GeV/c)^2$ is carried out using the most recent determinations of the relevant Regge trajectory intercepts and forward residues. The radii of interaction of the ρ- and ω-nonflip and ρ-flip contributions, treated as free parameters, are found to have values of 4.5, 5.1 and 4.5 $(GeV/c)^{-1}$ respectively. Particular attention is paid to the anomalous energy dependence of $K^- p$ polarisation and the lowlying σ-trajectory of Dash and Navelet is invoked to explain it. The author does not find any need for a pomeron-flip contribution in contrast to πN and NN scattering. Comparison of the authors results with some other works is made. (26 refs.)

13.75L Meson-meson interactions (energy ≤ 10 GeV)

Evolution condition for electroweak interactions in composite models ....See Entry 117409

13.85 HADRON-INDUCED HIGH- AND SUPER-HIGH-ENERGY INTERACTIONS, ENERGY > 10 GEV

(for low energies, see 13.75)

117492 Study of the reaction $\pi^- p \to K^*(890)\Lambda/\Sigma^0$. M.Saleem (Univ. of the Punjab, Lahore, Pakistan), M.Rafique.
Hadronic J. (USA), vol.6, no.4, p.1048-57 (July 1983).
It is shown that recent measurements of the data for differential and integrated cross sections as well as density matrix elements for $\pi^- p \to K^*(890)\Lambda/\Sigma^0$ at 10 GeV/c can be fitted by using simple Regge pole model with phenomenological residue functions. (7 refs.)

117493 Study of the reaction $\pi^- p \to K^0 \Lambda^0$. M.Saleem, M.Ali (High Energy Phys. Group, Univ. of the Punjab, Lahore, Pakistan).
Hadronic J. (USA), vol.6, no.4, p.1058-71 (July 1983).
The differential and integrated cross section data for the reaction $\pi^- p \to K^0 \Lambda^0$ from 3 to 15.7 GeV/c and the polarization data at 3 and 5 GeV/c are fitted by using simple Regge pole model with phenomenological residues. It is assumed that each of the two non-degenerate K^* and K^{**} trajectories, exchanged in this reaction, is coupled only to one of the two independent helicity amplitudes. (19 refs.)

117494 KNO distributions using the generalization of Novero-Predazzi's ansatz with three constraints. S.Krasznovszky, I.Wagner (Central Res. Inst. for Phys., Budapest, Hungary).
Nuovo Cimento A (Italy), vol.76A, ser.2, no.3, p.539-55 (1 Aug. 1983).
The method of Novero-Predazzi is applied to a set of ansatze ($m = 1,2,3,\ldots$) with three constraints. Hadronic-production cross-sections $\sigma_n(s)$ satisfying KNO-like constraints are determined. $\sigma_n(s)$ and $\langle n \rangle P_n$ automatically have the KNO scaling property. The generalization of the method is investigated for more than three constraints. Comparing the authors' results with the published data for $m = 1,2,\ldots,9$, they find that all calculated higher moments c_k of the KNO distribution for $m = 2$ are in excellent agreement with the observed values of c_ks for pp interactions at Serpukhov, FNAL and ISR energies. (15 refs.)

117495 Multiparticle production in 24, 50 and 400 GeV/c particle-nucleus interactions. A.Shakeel, H.Khushnood, M.Irfan, M.Zafar, A.Ahmad, M.Shafi (Dept. of Phys., Aligarh Muslim Univ., Aligarh, India).
Nuovo Cimento A (Italy), vol.76A, ser.2, no.4, p.699-714 (21 Aug. 1983).
Some interesting aspects of multiparticle production in 24 and 400 GeV/c p-nucleus and 50 GeV/c π^--nucleus collisions have been studied. The correlations of fast target protons with evaporated and shower particles produced in these interactions have been thoroughly investigated. The results reveal that the average number of shower particles produced in these interactions is in marked disagreement with the values predicted by the simple independent-particle and hydrodynamical models. Finally, on invoking the additive quark model, the mean normalized multiplicities R_4 and R_5 are observed to be independent of the nature of the projectile indicating a new kind of scaling in hadron-nucleus interactions. (20 refs.)

117496 Slopes, coherence and compositeness in high-energy collisions with nuclei. A.W.Hendry, D.B.Lichtenberg (Phys. Dept., Indiana Univ., Bloomington, IN, USA), E.Predazzi.
Nuovo Cimento A (Italy), vol.77A, ser.2, no.2, p.147-64 (21 Sept. 1983).
The authors examine some recent data on high-energy collisions involving nuclei. All the main features can be readily understood in terms of various degrees of coherence among the constituents. (17 refs.)

117497 Quantum chromodynamics and the rise of hadronic total cross sections. G.Cohen-Tannoudji, H.Navelet, R.Peschanski (CENS, Gif-sur-Yvette, France), A.Mantrach.
Phys. Rev. D (USA), vol.28, no.7, p.1628-35 (1 Oct. 1983).
The authors have computed the sum of all multiparton-production cross sections induced by one-hard-gluon exchange in the leading-logarithm approximation of QCD for high-energy hadronic collisions. The rise of hadronic total cross sections is explained by the excess of the rise of parton multiplicities with respect to the decrease of each individual cross section. They have shown that this rise is very sensitive to only one free parameter, namely the mass of the constituent quark, but not to other nonperturbative effects. With a reasonable value of 350 MeV, they have obtained a rise of 15 mb between CERN ISR and collider energies. (15 refs.)

Excited quarks and new hadronic states ....See Entry 117431

Jet production and fragmentation ....See Entry 117479

Study of the reactions $\pi^- p \to \pi^- \Delta^+$ and $\pi^- p \to \pi^0 \Delta^{++}$ at high energies ....See Entry 117487

13.85D Elastic scattering (energy > 10 GeV)

117498 pp elastic polarisation at 200 GeV/c and pomeron-flip. M.Kamran (Dept. of Phys., Punjab Univ., Lahore, Pakistan).
Hadronic J. (USA), vol.6, no.4, p.1029-33 (July 1983).
It is shown that a parameterisation based on a pomeron-flip contribution with $\alpha_p(t) \simeq 1.07 + 0.1$ t agrees with the recent 200 GeV/c pp elastic polarisation data in the $|t| \leq 1$ $(GeV/c)^2$ region. (3 refs.)

13.85H Inelastic scattering, many-particle final states (energy>10GeV)

117499 Strange-quark suppression in 225-GeV/*c* π^-Be interactions. P.Schoessow, G.O.Alverson, H.S.Budd, T.L.Graff, S.R.Hahn, L.E.Holloway, L.J.Koester, U.E.Kruse, W.-G.Li, P.T.Lukens, R.D.Sard (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA), D.A.Bauer, D.J.Judd, T.B.W.Kirk, T.Lagerlund, S.H.Pordes, R.Raja, L.D.Spires, A.A.Wehmann, J.W.Cooper, V.E.Barnes, C.Davis, A.F.Garfinkel, A.T.Laasanen, S.Hossain, R.H.Milburn, W.P.Oliver, R.K.Thornton.
Phys. Rev. D (USA), vol.28, no.7, p.1773-4 (1 Oct. 1983).
The authors report here on a new measurement of the strange-quark suppression factors λ, using data on $\omega(783)$ and $\phi(1020)$ mesons observed via the decay to $\mu^+\mu^-$. They find $\lambda = 0.31 \pm -0.05$, compared to a world average of about 0.29. (7 refs.)

Charge distribution in a two-chain dual model ....See Entry 117445

13.85K Inclusive reactions, including total cross sections, (energy > 10 GeV)

117500 Diffractive dissociation and the pp multiplicity distribution. K.Fialkowski (Werner Heisenberg Inst. fur Phys., Munich, Germany).
Acta Phys. Pol. B (Poland), vol.B14, no.9, p.679-88 (Sept. 1983).
Multiplicity distributions from proton-proton interactions are analysed in the framework of a two-component model. The asymptotic relations between the dispersion and average multiplicity are discussed using the new data on single proton diffraction at ISR energies. An incompatibility is indicated between the asymptotic stability of relevant phenomenological parameters and the universality of jet parameters for hadron- and lepton-induced processes. (22 refs.)

117501 Secondaries in p$\bar{\text{p}}$ colliders at SPS energies and a multiple production model. S.Bhattacharyya (Phys. & Earth Sci. Div., Indian Statistical Inst., Calcutta, India).
Fizika (Yugoslavia), vol.15, no.3, p.299-309 (July-Sept. 1983).
The recent experimental results obtained from the CERN PP colliders at *SPS* ($\sqrt{S}=540$ GeV) energies have been analysed on the basis of a new multiple production model proposed by Bandyopadhyay and Bhattacharyya. It is shown that the model can describe the data fairly well and passes some crucial tests even at such high energy. (22 refs.)

117502 Soft-gluon corrections to the Drell-Yan process. M.Friedman (Phys. Dept., Northeastern Univ., Boston, MA, USA), G.Pancheri, Y.N.Srivastava.
Nuovo Cimento A (Italy), vol.77A, ser.2, no.2, p.165-83 (21 Sept. 1983).
The 4-momentum distribution of multiple soft-gluon emission is studied using a Block-Nordsieck approach. An asymptotic separability is found. The effect in μ pair production is investigated and explicit expressions for the double differential cross-section are obtained. The slope of the mean transverse momentum with total energy is calculated and compared with data. The mean scaling curves are also in good agreement with experiment. Further tests are suggested. (24 refs.)

117503 Old quark backgrounds in new quark searches. F.Halzen (Res. Inst. for Theoretical Phys., Univ. of Helsinki, Helsinki, Finland), D.M.Scott.
Phys. Lett. B (Netherlands), vol.129B, no.5, p.341-5 (29 Sept. 1983).
Shows that in $\bar{\text{p}}$p events with a high p_T lepton, measurement errors in missing transverse energy allow b, c semileptonic decays to fake t's. The authors further discuss the event structure. (11 refs.)

117504 Production of vector-meson pairs in hadronic collisions. Bing-An Li, Keh-Fei Liu (Dept. of Phys. & Astron., Univ. of Kentucky, Lexington, KY, USA).
Phys. Rev. D (USA), vol.28, no.7, p.1636-43 (1 Oct. 1983).
Production in hadronic collisions of 2^{++} $Q^2\bar{Q}^2$ states which decay predominantly to vector-meson pairs are discussed based on a Drell-Yan-type mechanism with gluon fusion via the color vector-dominance model. The 2^{++} $\phi\phi$ resonance at 2.16 GeV produced in pp and πp collisions is interpreted as a 2^{++} $ss\bar{s}\bar{s}$ four-quark state. The calculated mass and width of this four-quark state, its characteristic S-wave decay, and the theoretical production cross sections in pp reaction at $p_L=400$ GeV/c and πp reaction at $p_L=100$ GeV/c are consistent with experimental data. Estimates of the hadronic production cross sections and their longitudinal- and transverse-momentum distributions for various channels of vector-meson pairs are also presented. (20 refs.)

117505 Proton fragmentation in deep inelastic scattering: a treatment in the valon-recombination model. R.C.Hwa (Dept. of Phys., Univ. of Oregon, Eugene, OR, USA), M.S.Zahir.
Z. Phys. C (Germany), vol.20, no.1, p.27-42 (1983).
A detailed analysis is presented for the fragmentation of a proton in deep inelastic scattering. The valon-recombination model is used as a framework for the description of proton structure on the one hand and of the hadronization of quarks on the other. No arbitrary parameters are involved in the treatment. Perturbative QCD is used to calculate the effects of scaling violation. Predictions are made for the pion inclusive distributions in the proton fragmentation region for semi-inclusive reactions induced by muon, neutrino and antineutrino. The results are determined for both π^+ and π^- at various Feynman x for different values of Bjorken x and Q^2. Resonance contribution in the final state has also been taken into account. (20 refs.)

Testing QCD at the proton-antiproton collider .... See Entry 117413

On the exponentiation of soft-gluon large corrections .... See Entry 117426

$\psi\psi$ production at collider energies .... See Entry 117429

Collisions to melt the vacuum .... See Entry 117586

13.88 POLARISATION IN INTERACTIONS AND SCATTERING

Asymmetries in $e^+e^-\rightarrow\gamma$, Z_1^0, $Z_2^0...\rightarrow\Sigma_q q\bar{q}\rightarrow 2$ jets due to neutral-current effects in the standard and extended gauge models .... See Entry 117396

Neutral-current effects in the standard and extended gauge models for spin polarization effects in $e^+e^-\rightarrow\mu^+\mu^-$ .... See Entry 117450

New measurement of deep-inelastic *e-p* asymmetries .... See Entry 117473

Calculation of weak neutral currents by the electro-production of pions on nucleons close to the nucleon resonances in the parton-quark model .... See Entry 117474

The general structure of polarization characteristics in deuteron electrodsintegration .... See Entry 117477

A phenomenological investigation of Kp elastic scattering at high energies and small momentum transfers .... See Entry 117491

Study of the reaction $\pi^-p\rightarrow K^0\Lambda^0$ .... See Entry 117493

pp elastic polarisation at 200 GeV/c and pomeron-flip .... See Entry 117498

13.90 OTHER TOPICS IN SPECIFIC REACTIONS AND PHENOMENOLOGY OF ELEMENTARY PARTICLES

117506 The quark mass effect of the distribution amplitudes in $\gamma\gamma$-exclusive processes. Tao Huang (Inst. of High Energy Phys., Acad. Sinica, Peking, China), Zhui-jian Shi.
Commun. Theor. Phys. (China), vol.2, no.3, p.1107-13 (1983).
The authors have analyzed the $\gamma^*\pi^\circ\rightarrow\gamma$, $\gamma\gamma\rightarrow\pi\pi$ and $\pi\pi\rightarrow\rho_\perp\rho_\perp$ processes by using the sum rules of the distribution amplitude $\phi_M(x_i,Q^2)$, which are obtained from the $\pi^\circ\rightarrow\gamma\gamma$ and the $\pi\rightarrow\mu\nu$ decay processes. Since the angular distributions of the $\gamma\gamma\rightarrow\pi^\circ\pi^\circ$ and $\gamma\gamma\rightarrow\rho_\perp\rho_\perp$ amplitudes are sensitive to the shape of the distribution amplitude $\phi_M(x_i,Q^2)$, there is a possibility to investigate the effect of the quark mass from the angular distributions of $\gamma\gamma\rightarrow MM$ exclusive processes. (7 refs.)

117507 Exclusive production of heavy mesons in photon-photon collisions: the double scattering mechanism. S.L.Grayson, R.R.Horgan, P.V.Landshoff (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
Z. Phys. C (Germany), vol.20, no.1, p.43-52 (1983).
The authors present two mechanisms which can complete with constituent interchange in the exclusive production at wide angle of heavy mesons in photon-photon collisions. They show that they have the same energy behavior as constituent interchange, and that their amplitudes are free from large logarithms. They exploit this to calculate the double-scattering diagrams numerically. They find that while constituent interchange dominates at 90°, double scattering becomes dominant for angles less than about 45°. (15 refs.)

Excited quarks and new hadronic states .... See Entry 117431

Effects of compositeness in deep inelastic scattering .... See Entry 117438

Search for light penetrating bosons with the use of a rotatable detector arrangement at a nuclear reactor .... See Entry 117471

14.00 PROPERTIES OF SPECIFIC PARTICLES AND RESONANCES

14.20 BARYONS AND BARYON RESONANCES

(inc. antiparticles)

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Sub-leading contributions to the intrinsic charm of the nucleon .... See Entry 117435

An analysis on the color Van der Waals force .... See Entry 117446

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Corrections to weak structure functions of the nucleon in the region of intermediate values of x .... See Entry 117464

Precision measurement of the magnetic moment of the Σ^- hyperon .... See Entry 117465

Proton and neutron magnetic moments from QCD sum rules .... See Entry 117466

Direct electromagnetic excitation $N\rightarrow\Delta(1232)$, final-state interactions, and the multipoles ${M_{1+}}^{(3/2)}$ and ${E_{1+}}^{(3/2)}$ of photopion production of nucleons in the range $160\lesssim E_\gamma\lesssim 800$ MeV .... See Entry 117475

Dibaryon resonance and aligned coupling states of nucleon and Δ isobar .... See Entry 117485

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14.40 MESONS AND MESON RESONANCES

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Theoretical perspectives on strange physics .... See Entry 117393

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Radiative decays of charmonium and constituent quark masses .... See Entry 117467

Electromagnetic decays of vector and axial mesons $\rho\rightarrow\pi+l^++l^-$ and $A_1\rightarrow\pi+l^++l^-$ .... See Entry 117470

Production of charmed mesons in e^+e^- annihilation at 10.5 GeV .... See Entry 117480

Observation of baryons in *B*-meson decay .... See Entry 117481

Inclusive D and D^* production in e^+e^- annihilation at 29 GeV .... See Entry 117482

A study of the reaction $K^-p\rightarrow\phi\Lambda$ at 4.2 GeV/c .... See Entry 117490

14.60 LEPTONS

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Natural generation of fermion masses .... See Entry 117400

A trouble for composite quark and lepton models? .... See Entry 117437

Lepton mixing and heavy neutrinos .... See Entry 117454

Angular correlations and the tau-neutrino mass .... See Entry 117462

Neutrino astrophysics and neutrino rest mass. II. Solar neutrinos and stellar collapse neutrinos .... See Entry 121648

A model of a neutrino stellar system and the upper bound of neutrino mass obtained from the rotation curves of some galaxies .... See Entry 121743

14.80 OTHER AND HYPOTHETICAL PARTICLES

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On the relationship between Abelian and SU_2 n-monopoles ... See Entry 117329

The stringless gague potential of accelerated monopole .... See Entry 117330

One-dimensional exactly integrable dynamical systems (classical and quantum regions) .... See Entry 117332

Boundary conditions on the monopole Dirac equation .... See Entry 117347

Monopoles and fermion number violation .... See Entry 117372

Experimental signals for supersymmetric decays of the W and Z bosons .... See Entry 117379

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Testing the standard model versus left-right models on the off the Z resonance ....See Entry 117407

Quarks, partons and quantum chromodynamics ....See Entry 117411

The role helicity asymmetries could play in the search for supersymmetric interactions ....See Entry 117422

Introduction to the chemistry of fractionally charged atoms: electronegativity .. ..See Entry 117433

A trouble for composite quark and lepton models? ....See Entry 117437

Finite-energy sum rules and light-quark masses ....See Entry 117448

$K \to \pi$+light pseudoscalar ....See Entry 117456

Search for light penetrating bosons with the use of a rotatable detector arrangement at a nuclear reactor ....See Entry 117471

Leptoquark production at HERA ....See Entry 117472

Old quark backgrounds in new quark searches ....See Entry 117503

Search for massive magnetic monopoles by plastic track detectors ....See Entry 117739

Calculation of the energy dissipated by slow monopoles into spinwaves ....See Entry 119827

Study of some aspects of extensive air showers at sea level ..See Entry 121486

The limits to the cross-section for magnetic monopole creation obtained from the persistence of the magnetic field of white dwarfs ....See Entry 121518

20.00 NUCLEAR PHYSICS

21.00 NUCLEAR STRUCTURE

21.10 GENERAL AND AVERAGE PROPERTIES OF NUCLEI; PROPERTIES OF NUCLEAR ENERGY LEVELS

(for properties of specific nuclei listed by mass ranges, see 27.)

117508 In-beam gamma spectroscopic investigation of ^{73}Se. Li Guang-sheng (Inst. of Atomic Energy, Acad. Sinica, Beijing, China), L.Cleemann, J.Eberth, T.Heck, W.Neumann, M.Nolte, J.Roth.
Chin. J. Nucl. Phys. (USA), vol.5, no.3, p.217-24 (Aug. 1983). In Chinese.
High spin states in ^{73}Se are investigated in the reaction ^{58}Ni(^{19}F, 3pnγ)^{73}Se at incident energies between 56 and 68 MeV using in-beam gamma spectroscopy. The γ-excitation functions, γ-single spectra, γ-γ coincidences, γ-angular distributions and lifetimes are measured by the recoil distance method applying neutron multiplicity technique. A decoupling band with positive parity based on the $9/2^+$ ground state is observed. Negative parity states up to $I^\pi=17/2^-$ can be properly described in the framework of the strong coupling rotation model. (19 refs.)

117509 Can a β-vibration band exist in ^{168}Er?. Lu Lin (Phys. Dept., Nat. Central Univ., Chung-Li, Taiwan), S.Y.Lee, S.F.Tsai, H.-T.Chen.
J. Phys. G (GB), vol.9, no.10, p.L223-7 (Oct. 1983).
A microscopic analysis using the projection before variation method is applied to study the $K^\pi=0^+$ two-quasiparticle bands in ^{168}Er and remarkable agreement with experiment is obtained. It is suggested that the $K^\pi=0^+$ excited bands in ^{168}Er are pure two-quasiparticle bands and cannot be identified as collective β-vibration bands. (21 refs.)

117510 Search for two-octupole-phonon states in ^{208}Pb. M.A.J.Mariscotti, D.R.Bes, S.L.Reich, H.M.Sofia (Dept. de Fisica, Comision Nacional de Energia Atomica, Buenos Aires, Argentina), P.Hungerford, S.A.Kerr, S.A.Schreckenbach, D.D.Warner, W.F.Davidson, W.Gelletly.
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.98-126 (3-10 Oct. 1983).
A search for two-phonon octupole vibrational states in ^{208}Pb was carried out using the ^{207}Pb(n$_{th}$,γ) reaction at the High Flux Reactor of the Institut Laue-Langevin. The conversion electron spectrum was scanned with the spectrometer BILL with a sensitivity of 20 μb in the 4-6 MeV interval. Coincidence and singles γ-ray measurements were performed at the end of the thermal neutron beam guide H22-F reaching a sensitivity of 80 μb for energies above 0.511 MeV. In addition the singles spectrum was investigated with the pair spectrometer at the tangential beam facility. Levels have been observed at (energies in keV and parenthesis for tentative level identification and spin-parity assignments): 2614.4, 3^-; 3997, (3^-); 4084.7, 2^+; 4253, (2^-, 3^-), 4704, (2^-, 3^-); (4882.0), (0^+); (49049), (0^+); 4935, 2^+; (6343), (2^+) and the 0^-, 1^- capture state at 7367.9 keV. The 4882.0 keV level probably corresponds to the known two-neutron pairing vibration. Possible candidates for two-phonon octupole excitations are the (0^+)(4904.9) and 2^+ 4935 keV states. (39 refs.)

117511 Band-crossing studied by Cooper-pair exchange particles-plus-soft rotor model. A.Ikeda (Dept. of Phys., Tokyo Inst. of Technol., Tokyo, Japan), N.Onishi.
Prog. Theor. Phys. (Japan), vol.70, no.1, p.128-43 (July 1983).
Extensive numerical calculations are performed to reproduce the experimental energy spectra of even Er-isotopes in the framework of particles-plus-soft rotor model. The full $|i_{13/2}{}^n(\nu\alpha)J\rangle$ space is employed in the calculation. A repulsive interaction in the form of **J.R** is introduced. Using the resultant wave functions, various electromagnetic properties are predicted. (13 refs.)

117512 An extension of the rotating shell model and its application to ^{164}Er. Y.R.Shimizu, K.Matsuyanagi (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.144-62 (July 1983).
The authors develop an RPA approach based on rotating potentials as an extension of the rotating shell model of nuclear high-spin states. The RPA formalism is applied to the positive-parity yrast spectrum of ^{164}Er. Properties at high spin of the pairing potentials and of the γ-vibrational bands are analyzed as functions of the rotational frequency. The result of calculation indicates an onset in the *s*-band of instability toward triaxial deformation. (28 refs.)

117513 Maximally decoupled collective submanifold in a simple solvable model. F.Sakata (Inst. for Nuclear Study, Univ. of Tokyo, Tokyo, Japan), Y.Hashimoto, T.Marumori, T.Une.
Prog. Theor. Phys. (Japan), vol.70, no.1, p.163-75 (July 1983).
The self-consistent collective-coordinate method formulated within the framework of the time-dependent Hartree-Fock theory is illustrated by using a simple solvable model. A concept of 'maximally-decoupled' collective submanifold obtained by this method turns out to be a so-called hypersurface in the 1*p*-1*h* phase space, on which the TDHF trajectory corresponding to the 'classical' large-amplitude collective motion travels. Various roles of dynamical and kinematical anharmonicity effects neglected under the random phase approximation are also clarified. (12 refs.)

117514 Residual interactions between aligned quasiparticles and pairing deformation changes in ^{165,166}Yb and ^{164}Er. Y.R.Shimizu, K.Matsuyanagi (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.319-21 (July 1983).
The authors explicitly evaluate the residual interactions between aligned quasiparticles that are associated with the decrease of the pairing deformation Δ. The result of analysis supports the suggestion by Roy et al. that the residual interactions arise mainly from the blocking effects. (11 refs.)

117515 g Factors of the s band in ^{164}Er and ^{166}Yb. Y.Nagai, T.Shibata, H.Ohsumi, H.Ejiri (Dept. of Phys., Osaka Univ., Osaka, Japan).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1247-50 (3 Oct. 1983).
The g factors of the s-band 12^+ levels in ^{164}Er and ^{166}Yb were studied by measuring γ-ray angular distributions and internal conversion coefficients with use of a new electron spectrometer for the interband $12_s{}^+ \to 12_g{}^+$ transitions. The g factors were deduced for the first time to be $g=0.07 \pm 0.03$ for ^{164}Er and -0.14 ± 0.04 for ^{166}Yb. These small values indicate clearly the rotation alignment of the $i_{13/2}$ neutrons for the s band. (14 refs.)

117516 g-boson renormalization effects in the interacting boson model for nondegenerate orbits. P.D.Duval (Dept. of Phys., Carnegie-Mellon Univ., Pittsburgh, PA, USA), S.Pittel, B.R.Barrett, C.H.Druce.
Phys. Lett. B (Netherlands), vol.129B, no.5, p.289-93 (29 Sept. 1983).
A nonperturbative model-space truncation procedure is utilized to include the effects of a single g boson on the parameters of the neutron-proton Interacting Boson Model in the realistic case of nondegenerate single-particle orbits. Particular emphasis is given to the single-boson energies ϵd_ρ ($\rho=\nu,\pi$), with numerical results presented for the even isotopes of Hg. Only part of the observed renormalization is obtained. Possible sources of further renormalizations to ϵd_ρ are discussed. Results are also presented for the renormalizations of the boson quadrupole parameters κ and χ_ρ. (16 refs.)

Multiple Coulomb excitation of ^{167}Er ....See Entry 117539

Jacobian free global event analysis ....See Entry 117560

In-beam investigation of high-spin states in actinides with (α,xn) compound reactions ....See Entry 117581

21.10D Binding energy and masses

117517 Effective mass in nuclei. P.E.Hodgson (Nuclear Phys. Lab., Univ. of Oxford, Oxford, England).
Contemp. Phys. (GB), vol.24, no.5, p.491-503 (Sept.-Oct. 1983).
The concept of effective mass may be used to describe the motion of a nucleon in the nuclear field, at both positive and negative energies. The anomaly around the Fermi energy associated with an energy-dependent effective mass is due to increased absorption in that region. The overall energy dependence of the single-particle potential is associated with the momentum dependence of the Hartree-Fock field. The phenomenological determination of the effective mass from analyses of elastic scattering and other data is described. (28 refs.)

117518 Generalized Hugenholtz-Van Hove theorem and a new mass relation for finite nuclei. L.Satpathy (Inst. of Phys., Bhubaneswar, India), R.Nayak.
Phys. Rev. Lett. (USA), vol.51, no.14, p.1243-6 (3 Oct. 1983).
The usual Hugenholtz-Van Hove theorem for a Fermi system is extended to describe asymmetric nuclear matter. It has been further developed to describe finite nuclei. It is shown that this extended relation could be used as a basis for a new mass relation which has both the liquid-drop and single-particle features. Its success in predicting masses of exotic neutron-rich nuclei is demonstrated. (9 refs.)

117519 The triton binding energy and nd-scattering lengths with account of a quark nucleon structure. N.M.Petrov, A.M.Pushkash.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1304-7 (Sept. 1983). In Russian.
A simple model for the nucleon-nucleon interaction is suggested which takes into account the quark nucleon structure. The triton binding energy and the nd-scattering lengths are calculated on the basis of the model. (17 refs.)

117520 Atomic masses of rare earth isotopes ^{145}Pm and ^{151}Gd, derived from decay measurements of ^{145}Sm and ^{151}Gs. E.Voth, W.-D.Schmidt-Ott (II. Phys. Inst., Univ. Gottingen, Gottingen, Germany), H.Behrens.
Z. Phys. A (Germany), vol.313, no.3, p.167-72 (1983).
The comparison of experimental with calculated K-capture probabilities yielded the decay energies of ^{145}Sm and ^{151}Gd, Q_{EC}=622(5) and 463(3) keV, respectively. Earlier discrepancies in the mass adjustment of these isotopes were removed and adjusted masses for ^{145}Sm, ^{145}Pm and ^{151}Gd derived. In the decay of ^{151}Gd five new γ-rays were found and the half-life remeasured to be 129(4)d. (32 refs.)

Beta-decay energy and nuclear mass of ^{100}Nb ....See Entry 117555

21.10F Shape, charge, radius and form factors

117521 Structure information n ^{38}K obtained from a microscopic and macroscopic DWBA analysis of the ^{40}Ca(p,^{3}He)^{38}K reaction. J.C.Sens (Centre de Recherches Nucleaires, Univ. Louis Pasteur, Strasbourg, France), R.J.De Meijer.
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.45-59 (3-10 Oct. 1983).
The ^{40}Ca(p,^{3}He)^{38}K reaction has been investigated at E_p=35 MeV. Angular distributions for levels in ^{38}K with E_x<5.3 MeV have been analyzed in terms of a single-step zero-range DWBA with macroscopic as well as microscopic form factors. Besides J^π information, this analysis provides two-nucleon spectroscopic factors. Comparison is made with results of a shell-model calculation. Similar information has been obtained for the first two levels of ^{38}Ca by the ^{40}Ca(p,t)^{38}Ca reaction observed simultaneously. (16 refs.)

The effect of confinement size on nuclear structure functions ....See Entry 117423

Residual interactions between aligned quasiparticles and pairing deformation changes in ^{165,166}Yb and ^{164}Er ....See Entry 117514

21.10H Spin, parity, and isobaric spin

In-beam gamma spectroscopic investigation of ^{73}Se .... See Entry 117508

Search for two-octupole-phonon states in ^{208}Pb .... See Entry 117510

Excited states in ^{128}Ba .... See Entry 117525

Lifetime of the 1.04 MeV 0^+, $T=1$ state in ^{18}F .... See Entry 117546

A study of ^{206}Pb by inelastic scattering of 35 MeV protons .. See Entry 117570

21.10J Spectroscopic factors

Proton correlations and the missing M1 strength in ^{48}Ca: a two-state model .... See Entry 117540

21.10K Electromagnetic moments

On the determination of the deuteron quadrupole moment by elastic scattering of polarised deuterons .... See Entry 117575

An approach to electrostatic interaction by using the elliptic functions .... See Entry 118029

21.10M Level density and structure

117522 Monopolar approximation to the P-H spectra of heavy calcium isotopes. A.Dobado, A.Poves (Dept. de Fisica Teorica, Univ. Autonoma de Madrid, Madrid, Spain).
An. Fis. Ser. A (Spain), vol.79, no.2, p.130-5 (May-Aug. 1983). [received: Oct. 1983]
The authors study the P-H spectra of heavy Ca isotopes using the monopolar isoscalar and isovector approximation. Shell model calculations using effective interactions are compared with experimental results. (6 refs.)

117523 Semi-microscopic calculation of trinucleon cluster states in ^{18}F and ^{18}O. A.C.Merchant (SERC, Daresbury Lab., Warrington, England).
J. Phys. G (GB), vol.9, no.10, p.1169-92 (Oct. 1983).
A strikingly successful phenomenological model which treated a number of low-lying negative-parity states in ^{18}F and ^{18}O as having the structure of an ($A=3$) cluster orbiting an ($A=15$) core is considered. An attempt is made to justify the assumptions inherent in this model on more microscopic grounds. To do this, an effective, local cluster-core potential containing central, spin-orbit, spin-spin and tensor-spin components is derived from the shell-model approximation to the ground state of the ($A=15$) core and a nucleon-trinucleon potential. This latter potential would ideally be obtained from a phase-shift analysis of nucleon-trinucleon scattering data but, in the absence of sufficiently detailed experiments to do this, a family of such potentials, whose non-central terms are taken to have Gaussian geometries of various widths and strengths chosen by considering some of the excited states of the $A=4$ nuclei, is derived and used. Many of the phenomenological assumptions are then semi-microscopically vindicated, and quite reasonable quantitative agreement with the free parameters of the phenomenological model and the measured energies of the trinucleon cluster states in ^{18}F and ^{18}O is obtained. (32 refs.)

117524 Low-lying states of the ^{102}Rh nucleus. Z.Dombradi, A.Krasznahorkay, J.Gulyas (Inst. of Nuclear Res., Hungarian Acad. of Sci., Debrecen, Hungary).
Z. Phys. A (Germany), vol.313, no.3, p.207-11 (1983).
The γ-spectra and γ excitation functions of the ^{102}Ru($p,n\gamma$)^{102}Rh reaction were measured with Ge(Li) and hyperpure Ge spectrometers at various bombarding proton energies between 3.20 and 4.05 MeV. The γ-ray energies and intensities as well as the threshold energies were determined, and 43 new γ-rays were assigned to the ^{102}Rh nucleus. $\gamma\gamma$-coincidence measurements were performed too at 4 MeV bombarding proton energy with Ge(Li) spectrometers. The level scheme of ^{102}Rh was deduced up to 580 keV excitation energy and 12 previously unobserved levels were placed in the scheme. (7 refs.)

117525 Excited states in ^{128}Ba. K.Schiffer, A.Dewald, A.Gelberg, R.Reinhardt, K.O.Zell (Inst. fur Kernphys., Univ. zu Koln, Koln, Germany), S.Xiangfu.
Z. Phys. A (Germany), vol.313, no.3, p.245-6 (1983).
Excited states of ^{128}Ba have been investigated via the ^{118}Sn (^{13}C,3n) reaction by means of in-beam gamma spectroscopy. 28 new levels and several spin and parity assignments were established, revealing the existence of two superbands and a tentative new negative parity band. (9 refs.)

Dibaryon resonance and aligned coupling states of nucleon and Δ isobar .... See Entry 117485

Lifetime of the 1.04 MeV 0^+, $T=1$ state in ^{18}F .... See Entry 117546

A study of ^{206}Pb by inelastic scattering of 35 MeV protons .. See Entry 117570

Band structure in ^{81}Sr .... See Entry 117579

21.30 NUCLEAR FORCES

(see also 13.75C Nucleon-nucleon interactions)

117526 Pion condensation and medium polarization effects on the spin-isospin-dependent particle hole interaction. R.Cenni, G.Dillon, P.Saracco (Istituto de Sci. Fisiche, Univ. Genova, Genova, Italy).
Nuovo Cimento A (Italy), vol.77A, ser.2, no.2, p.231-48 (21 Sept. 1983).
In the context of possible precursor phenomena of a phase transition in nuclear matter the authors have considered the effects of the dressing of π and ρ mesons on the relevant particle holes spin-isospin-dependent residual interaction g'. The model takes into account the contributions to g' due to the direct exchange of π and ρ mesons in the presence of short-range correlations. Since the exact self-energies are expressed effectively through g', one is faced with a self-consistent problem which the authors have solved numerically at increasing densities. (16 refs.)

The constancy of the laws of physics in the light of prehistoric nuclear reactors .... See Entry 116944

An analysis on the color Van der Waals force .... See Entry 117446

Effective mass in nuclei .... See Entry 117517

The triton binding energy and nd-scattering lengths with account of a quark nucleon structure .... See Entry 117519

Pairing effects at finite temperature and finite rotational frequencies: an exactly soluble model .... See Entry 117531

21.40 FEW-NUCLEON SYSTEMS

The triton binding energy and nd-scattering lengths with account of a quark nucleon structure .... See Entry 117519

21.60 NUCLEAR-STRUCTURE MODELS AND METHODS

(for hadronic atoms and molecules, see 36.10)

117527 The dependence on spin of *S* wave neutron strength function. Zhao Zhixiang (Inst. of Atomic Energy, Acad. Sinica, Beijing, China).
Chin. J. Nucl. Phys. (USA), vol.5, no.3, p.273-8 (Aug. 1983). In Chinese.
The statistical method is used to examine the dependence of the neutron strength function on the spin so as to avoid the difficulty caused by lack of spin data. Based on the assumption that the level density is proportional to $(2J+1)$, the reduced neutron width for each population obeys Porter-Thomas distribution and $K=\langle g\Gamma_n^{\,0}(J_1)\rangle/\langle g\Gamma_n^{\,0}(J_2)\rangle$, the superposed distribution with parameter K and random variable $t=g\Gamma_n^{\,0}/\langle g\Gamma_n^{\,0}\rangle$ for two populations are derived. 2595 data are analysed by using the maximum likelihood function and moments method. The result indicates that the neutron strength function for S wave is independent of spin. (7 refs.)

The effect of confinement size on nuclear structure functions .... See Entry 117423

Thermostatic properties of semi-infinite nuclear matter. II. The asymmetric case .... See Entry 117534

21.60C Shell model

Monopolar approximation to the P-H spectra of heavy calcium isotopes .... See Entry 117522

Numerical test of a modified boson method for multi-phonon states. Single j-shell case .... See Entry 117530

Proton correlations and the missing M1 strength in ^{48}Ca: a two-state model .... See Entry 117540

A study of the (^{6}Li,^{7}Be) reaction in the mass-90 region at 60 MeV .... See Entry 117582

21.60E Collective models

117528 Electromagnetic transitions and radiative capture in the generator-coordinate method. D.Baye, P.Descouvemont (Phys. Theorique et Math., Univ. Libre de Bruxelles, Brussels, Belgium).
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.77-97 (3-10 Oct. 1983).
A microscopic study of the electromagnetic properties of nuclei and or radiative capture reactions is presented in the framework of the generator-coordinate method. Fully antisymmetrized wave functions, with a correct asymptotic behaviour, are used to calculate matrix elements of the multipole operators in the long-wavelength approximation. Centre-of-mass corrections are shown to vanish exactly in this approximation. Approximate forms are derived when antisymmetrization is negligible. The E2, E3 and M2 transitions in ^{20}Ne and the ^{16}O(α,γ)^{20}Ne radiative capture reaction are treated as illustrative examples. (27 refs.)

117529 A class of simple Hamiltonians with degenerate ground state. II. A model of nuclear rotation: Spontaneous breakdown of rotation symmetry and Goldstone theorem for finite dimensional system. H.Ui, G.Takeda (Dept. of Phys., Tohoku Univ., Sendai, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.176-88 (July 1983).
For pt.I see ibid., vol.69, p.1146 (1983). The authors construct a manifestly rotation invariant Hamiltonian describing a system composed of a tensor boson with spin $I=2$—such as, for example, phonon of nuclear quadrupole surface vibration—in which special cubic and quartic self-interactions are taken into account. All the ground state solutions are obtained. It is shown that these solutions can be classified into three classes: The first is the normal vacuum of boson, which is manifestly rotation symmetry. The second class of solutions can be viewed as generated from a single chosen state by rotating it into an arbitrary direction. The third one is Goldstone modes built on this chosen ground state. This chosen state—an exact ground state solution of our rotation invariant Hamiltonian—is not an eigenstate of angular momentum, but contains infinitely many different angular momentum states in it; thus, typifying 'spontaneous breakdown' of 'rotation symmetry'. It is further shown that this state can be naturally identified to an 'intrinsic' deformed state in nuclear collective model of Bohr and Mottelson. The results are examined from the standpoint of Goldstone theorem and detailed discussions are given to explore how Goldstone theorem is modified in our finite dimensional system. (10 refs.)

117530 Numerical test of a modified boson method for multi-phonon states. Single j-shell case. M.Hasegawa, N.Kanesaki (Lab. of Phys., Fukuoka Dental Coll., Fukuoka, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.315-18 (July 1983).
A modified boson method including the SU(6) model and the interacting boson model is numerically tested. Calculations show that the model well reproduces the energies and the B(E2) values obtained in the phonon-truncated shell model. (7 refs.)

117531 Pairing effects at finite temperature and finite rotational frequencies: an exactly soluble model. O.Civitarese, A.Plastino, A.Faessler (Inst. fur Theoretische Phys., Univ. Tubingen, Tubingen, Germany).
Z. Phys. A (Germany), vol.313, no.3, p.197-206 (1983).
The competition between thermal excitations and rotational degrees of freedom and their influence on the pairing correlations are studied within the framework of an exactly soluble model. The model is based on an $SU(2)\times SU(2)$ representation and it proved to be able to reproduce the collapse of the pairing correlations as a result of both the rotational alignment and the thermal blocking. The validity of the BCS approximation as a function of the temperature and the rotational frequency is discussed. (22 refs.)

117532 Correlated-pair structure in nuclei and possible relation to IBM-2. J.N.L.Akkermans, E.Loriaux, K.Allaart, G.Bonsignori (Natuurkundig Lab., Vrije Univ., Amsterdam, Netherlands).
Z. Phys. A (Germany), vol.313, no.3, p.213-25 (1983).
The broken-pair model is used to study the nature of collective pair structure in even nuclei and a possible connection with the interacting-boson model IBM-2. When microscopically computed quantities are compared with currently used parameters in IBM fits, the authors find not only a considerable renormalization of boson energies, but also of the proton-neutron interaction. One effect responsible for this is Pauli blocking which makes the interaction seniority dependent. The trend of the proton-neutron interaction

parameter κ agrees with single-shell formulas, but for the IBM parameters χ^{ρ} single-shell predictions are of little value. With some rules of thumb for renormalization the calculated parameters come close to those found in empirical fits. (35 refs.)

In-beam gamma spectroscopic investigation of ^{73}Se ....See Entry 117508

Can a β-vibration band exist in ^{168}Er? ....See Entry 117509

Band-crossing studied by Cooper-pair exchange particles-plus-soft rotor model ....See Entry 117511

An extension of the rotating shell model and its application to ^{164}Er ....See Entry 117512

Maximally decoupled collective submanifold in a simple solvable model ....See Entry 117513

Residual interactions between aligned quasiparticles and pairing deformation changes in ^{165,166}Yb and ^{164}Er ....See Entry 117514

g-boson renormalization effects in the interacting boson model for nondegenerate orbits ....See Entry 117516

Nuclei: a superfluid condensate of α particles? A study within the interacting-boson model ....See Entry 117535

Jacobian free global event analysis ....See Entry 117560

21.60F Models based on group theory

g-boson renormalization effects in the interacting boson model for nondegenerate orbits ....See Entry 117516

Numerical test of a modified boson method for multi-phonon states. Single j-shell case ....See Entry 117530

Correlated-pair structure in nuclei and possible relation to IBM-2 ....See Entry 117532

Nuclei: a superfluid condensate of α particles? A study within the interacting-boson model ....See Entry 117535

21.60G Cluster models

117533 The Lipkin pseudospin model in the variational exp*S* formalism. J.Arponen (Res. Inst. for Theoretical Phys., Univ. of Helsinki, Helsinki, Finland), J.Rantakivi.
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.141-62 (3-10 Oct. 1983).
The variational extended exp*S* formulation of the coupled-cluster method is numerically studied and applied to the many-particle model of Lipkin, Meshkov and Glick. In contrast to the standard exp*S* scheme the new method is shown to give good results even in the deformed phase without explicit introduction of a new single-particle basis. The ground-state energies are found to satisfy the variational property of being upper limits to the exact energies. Also the excitation energies are in a satisfactory overall agreement with the true ones for arbitrary interaction strengths. Special attention is paid to the phase-transition region of the interaction strength parameter. (16 refs.)

Semi-microscopic calculation of trinucleon cluster states in ^{18}F and ^{18}O ....See Entry 117523

Light *p*-shell Δ-hypernuclei by the microscopic three-cluster model ....See Entry 117537

Quasi-free reaction ^{12}C(p,d^{3}He)^{8}Be ....See Entry 117567

21.60J Hartree-Fock and random-phase approximations

An extension of the rotating shell model and its application to ^{164}Er ....See Entry 117512

Maximally decoupled collective submanifold in a simple solvable model ....See Entry 117513

21.65 NUCLEAR MATTER

117534 Thermostatic properties of semi-infinite nuclear matter. II. The asymmetric case. X.Vinas, M.Pi, M.Barranco (Facultad de Fisica, Univ. de Barcelona, Barcelona, Spain).
J. Phys. G (GB), vol.9, no.10, p.1193-8 (Oct. 1983).
For pt.I see Phys. Lett., vol.124B, no.3,4, p.131-4 (1983). Low-temperature (*T*) properties of hot, asymmetric nuclear matter have been studied with the hot, modified Thomas-Fermi (HMTF) method. The evolution with *T* of volume, volume symmetry, surface and surface symmetry energies corresponding to several Skyrme forces is presented. (11 refs.)

117535 Nuclei: a superfluid condensate of α particles? A study within the interacting-boson model. Y.K.Gambhir, P.Ring (Phys.-Dept., Tech. Univ. Munchen, Garching, Germany), P.Schuck.
Phys. Rev. Lett. (USA), vol.51, no.14, p.1235-8 (3 Oct. 1983).
The authors have studied the question of whether pairs of neutrons and pairs of protons of the usual superfluid phases form a bound state to give rise to a superfluid condensate of 'α particles'. They indeed find indications for this to be the case from a BCS-like study for bosons using the proton-neutron interacting-boson model as well as from an even-odd effect in the number of pairs using experimental binding energies. (11 refs.)

Generalized Hugenholtz-Van Hove theorem and a new mass relation for finite nuclei ....See Entry 117518

Pion condensation and medium polarization effects on the spin-isospin-dependent particle hole interaction ....See Entry 117526

Liquid-gas phase transition in nuclear matter ....See Entry 121525

21.80 HYPERNUCLEI

117536 Hyperon and hypernuclear physics with intense beams. B.F.Gibson (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
AIP Conf. Proc. (USA), no.102, p.43-53 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
A brief examination of progress in the study of hypernuclear physics and the hyperon-nucleon interaction is presented. The use of Λ-hypernuclei in the study of conventional (nonstrange) nuclei is explored. The status of the hyperon-nucleon force problem is reviewed. Anecdotal results are discussed for baryon numbers 4 and 13. Σ-hypernuclei are discussed. Production of $S=-2$ hypernuclei is mentioned. (7 refs.)

117537 Light *p*-shell Δ-hypernuclei by the microscopic three-cluster model. T.Motoba (Lab. of Phys., Osaka Electro-Communication Univ., Osaka, Japan), H.Bando, K.Ikeda.
Prog. Theor. Phys. (Japan), vol.70, no.1, p.189-221 (July 1983).
A systematic investigation of ${}_{\Lambda}^{6}$He, ${}_{\Lambda}^{6}$Li, ${}_{\Lambda}^{7}$Li, ${}_{\Lambda}^{8}$Li and ${}_{\Lambda}^{9}$Be hypernuclei is carried out within the framework of the microscopic $a+x+\Lambda$ cluster-model dynamics (x+n, p, d, t, or a). The positive and negative parity energy spectra are analysed in detail and are classified into several characteristic 'bands' according to the underlying structures. The E2, E1 and M1 λ-ray transition probabilities and magnetic dipole moments are calculated. The intraband B(E2)s are obtained to be several times enhanced in comparison with the shell-model values. The level widths of the strong peaks observed at lower B_{Λ} are roughly evaluated on the basis of the calculated reduced width amplitudes. The existing data can be well explained by the present model. The cluster-model estimates of the effective neutron number $N_{eff}(\theta=0°)$ for the (K^{-}, π^{-}) reaction are consistent with the experiments. (43 refs.)

23.00 RADIOACTIVITY AND ELECTROMAGNETIC TRANSITIONS

(see also 82.55 Radiochemistry)

23.20 ELECTROMAGNETIC TRANSITIONS

117538 Gamma-ray-spectrometry measurements for actinide decay-scheme studies with particular reference to ^{231}Pa and ^{235}U. M.F.Banham, R.Jones (Chem. Div., AERE, Harwell, England).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1225-31 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
The ^{231}Pa results reported agree well with previously published data over most of the energy range but highlight the difficulty of low-energy measurements. The low-energy gamma rays present problems which need to be solved because of their importance in the construction of the complete decay scheme. The emissions per decay of the γ-rays below 25 keV are low due to high conversion coefficients and their energies are very similar to those of the L-X-rays which dominate this region of the spectrum. The ^{235}U results reported agree very closely with those of Vaninbroukx (1982) and must therefore add weight to the case for a revision of the accepted values first published by Hyde (1964). The value for the 185.7-keV peak is of particular importance in the nuclear industry as it is used in many analytical applications. (13 refs.)

117539 Multiple Coulomb excitation of ^{167}Er. M.Ohshima, E.Minehara, M.Ishii (JAERI, Ibaraki, Japan), T.Inamura, A.Hashizume.
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.2959-62 (Sept. 1983).
The ground-state rotational band in ^{167}Er has been investigated through multiple Coulomb excitation with a 160-MeV ^{35}Cl beam. Excited states up to $25/2^{+}$ were established by measuring γ-γ coincidences and γ-ray angular distributions. Nuclear lifetimes for levels up to spin 23/2 have been determined by analysis of Doppler broadened γ-ray lineshapes. Considerable signature dependence was observed in level energies and M1 transition probabilities.

117540 Proton correlations and the missing M1 strength in ^{48}Ca: a two-state model. W.Knupfer, B.C.Metsch (Inst. fur Theoretische Phys., Univ. Erlangen-Nurnberg, Erlangen, Germany), A.Richter.
Phys. Lett. B (Netherlands), vol.129B, no.6, p.375-8 (6 Oct. 1983).
The recently measured spectroscopic factor for proton pick-up on ^{48}Ca is exploited to estimate the influence of proton correlations on the strength of the magnetic dipole excitation at $E_{X}=10.23$ MeV in ^{48}Ca. A calculation within the framework of a two-state shell-model for both the 0^{+} ground state and the 1^{+} excited state indicates that the presence of proton correlations does not account for the missing M1 strength. (21 refs.)

Revision of the evaluated UKCNDC Activation-Product Decay-Data Library ... .See Entry 116933

In-beam gamma spectroscopic investigation of ^{73}Se ....See Entry 117508

g Factors of the s band in ^{164}Er and ^{166}Yb ....See Entry 117515

Electromagnetic transitions and radiative capture in the generator-coordinate method ....See Entry 117528

Light *p*-shell Δ-hypernuclei by the microscopic three-cluster model ....See Entry 117537

Decay of ^{109g}Pd to the levels of ^{109}Ag ....See Entry 117541

Self-consistent calculations of nuclear response for closed-shell nuclei ....See Entry 117564

Investigation of the ^{48}Ti(n,γ)^{49}Ti reaction ....See Entry 117569

Low-lying levels in ^{125}Xe and ^{127}Xe ....See Entry 117580

23.20C Lifetimes and transition probabilities

117541 Decay of ^{109g}Pd to the levels of ^{109}Ag. M.B.Chatterjee, B.B.Baliga (Saha Inst. of Nuclear Phys., Calcutta, India).
Fizika (Yugoslavia), vol.15, no.3, p.273-82 (July-Sept. 1983).
The decay of ^{109g}Pd activity has been studied through high resolution gamma spectroscopy. The half-life of the decay of ^{109g}Pd activity has been measured and found to be 13.85±0.17 hour. On the basis of half-life measurements, gamma-rays have been assigned to ^{109}Ag. A level scheme for ^{109}Ag has been proposed and the assignment of 706.9, 910.7, 912.2 and 1099.1 keV levels have been confirmed. The spin-parities of the levels of ^{109}Ag have been discussed. The properties of the levels have been discussed in the light of the theoretical predictions. (29 refs.)

117542 Half-life measurements at the PTB. K.F.Walz, K.Debertin, H.Schrader (Phys.-Tech. Bundesanstalt, Braunschweig, Germany).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1191-9 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
During the past decade the PTB has measured half lives of more than 35 radionuclides aiming at relative uncertainties of 10^{-4} or less by following the decay of the radioactive substance in a source. The favourite radiation detector was a $4\pi\gamma$ pressurized ionization chamber. The total set of all data measured for a radionuclide was evaluated by a regression analysis. In addition, data sub-groups were evaluated individually in order to discover possible systematic errors and to facilitate the estimation of a realistic uncertainty. (9 refs.)

117543 Half-life measurements of excited levels in the nanosecond and microsecond region. D.Mouchel, H.H.Hansen (Commission of the European Communities, Central Bur. for Nuclear Measurements, Geel, Belgium).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1201-10 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
The application of the delayed-coincidence technique to accurate half-life measurements of excited levels in the nanosecond and microsecond region is described. In order to achieve an overall uncertainty of $\leq 1\%$ on the final values of the half lives a series of precautions depending on the time region have to be taken. In the nanosecond time range the most serious sources of errors are jitter, walk and drift phenomena. To minimize those the time pickoff has to be defined carefully by means of modern fast timing detectors and electronics. In the microsecond time range the ratio of true delayed coincidence to chance coincidences influences considerably the final accuracy of the half-life measurements. It must be the aim to reduce the chance-coincidence rate as much as possible. The successful application of the experimental procedures described yielded the following half-life values for the 37.1-keV level in ^{121}Sb (3.46 ± 0.03)ns, the 81-keV level in ^{133}Cs (6.23 ± 0.03)ns, the 482.18-keV level in ^{181}Ta (10.67 ± 0.05)ns, the 23.87-keV level in ^{119}Sn (18.03 ± 0.07)ns, the 6.21-keV level in ^{181}Ta $(6.05\pm0.12)\mu$s and the 615.25-keV level in ^{181}Ta $(17.64\pm0.14)\mu$s. (35 refs.)

117544 Half life and KX-ray-emission probability of ^{93}Nb^{m}. R.Vaninbroukx (Commission of the European Communities, Central Bur. for Nuclear Measurements, Geel, Belgium).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1211-14 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
The half life and KX-ray-emission probability of ^{93}Nb^{m} were measured to be (16.13 ± 0.15) y and 0.115 ± 0.003, respectively. The half-life result is in excellent agreement with a recently published value, but the KX-ray-emission probability value is about 7.5% higher than the only other available experimental result, quoted with an uncertainty of $\pm2.8\%$. (13 refs.)

117545 Lifetimes of excited levels in ^{47}Ca and ^{39}Ca. P.A.Mando, P.Sona, N.Taccetti (Dipartimento di Fisica, Univ. di Firenze, Firenze, Italy), F.Brandolini, C.Rossi Alvarez, M.De Poli.
J. Phys. G (GB), vol.9, no.10, p.1211-16 (Oct. 1983).
The Doppler-shift attenuation method has been used to determine lower limits for the lifetimes of the first, second and third excited states in ^{47}Ca. The limits obtained are 9, 17 and 2 ps, respectively. As a check, the known lifetime of the first excited state in ^{39}Ca has been remeasured ($\tau=230_{-30}^{+40}$ fs). (12 refs.)

117546 Lifetime of the 1.04 MeV 0^{+}, $T=1$ state in ^{18}F. W.N.Catford, E.F.Garman, D.M.Pringle, L.K.Fifield (Nuclear Phys. Lab., Univ. of Oxford, Oxford, England).
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.255-68 (3-10 Oct. 1983).
The mean life of the 1.04 MeV O^{+}, $T=1$ state in ^{18}F has been measured as 2.2 ± 0.6 fs using a refinement of the Doppler-shift attenuation method. The reaction ^{3}He(^{16}O,p)^{18}F at a mean beam energy of 26.6 MeV was used to populate the 1.04 MeV level with a recoil velocity $v/c=4.4\%$. The targets were ^{3}He implanted in foils of magnesium, aluminium, tantalum and gold. The result is compared with shell-model calculations, and its relevant to the search for parity non-conservation in the system comprising the 1.04 Mev level and the 1.08 MeV 0^{-}, $T=0$ level in ^{18}F is discussed. (20 refs.)

In-beam gamma spectroscopic investigation of ^{73}Se ....See Entry 117508

Gamma-ray-spectrometry measurements for actinide decay-scheme studies with particular reference to ^{231}Pa and ^{235}U ....See Entry 117538

Multiple Coulomb excitation of ^{167}Er ....See Entry 117539

Self-consistent calculations of nuclear response for closed-shell nuclei ....See Entry 117564

Investigation of the ^{48}Ti(n,γ)^{49}Ti reaction ....See Entry 117569

Band structure in ^{81}Sr ....See Entry 117579

23.20N Internal conversion and extranuclear effects

117547 K/LM+ internal-conversion ratios for pure E2 transitions in the decays of ^{152}Eu and ^{192}Ir. H.H.Hansen, D.Mouchel (Commission of the European Communities, Central Bur. for Nuclear Measurements, Geel, Belgium).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1233-9 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
Measurements have been made with a magnetic β-ray spectrometer in order to determine the internal-conversion ratio R=K/LM+ for pure E2 transitions of 244.7 and 344.3 keV in the decay of ^{152}Eu and of 205.8 and 316.5 keV in the decay of ^{192}Ir. The results from several experimental runs for each transition are respectively, $R=2.92\pm0.05$, 3.43 ± 0.05, 1.05 ± 0.04 and 1.71 ± 0.05. A comparison has been made with previously published results as well as with theoretical values deduced for pure E2 multipolarity from the most recent tabulations of internal-conversion coefficients. (25 refs.)

23.40 BETA DECAY; ELECTRON AND MUON CAPTURE

117548 Standardization and decay data of ^{169}Yb. E.Funck, U.Schotzig, K.F.Walz (Phys.-Tech. Bundesanstalt, Braunschweig, Germany).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1215-24 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
The gamma- and X-ray-emission probabilities per decay of ^{169}Yb were determined directly from the ratio of the emission rates and the activity. The emission rates were measured with calibrated semiconductor spectrometers and the activity with $4\pi\beta$-γ coincidence counting systems and a $4\pi\gamma$-NaI(Tl) high-efficiency-counting device. Measurements of the half life were carried out with a $4\pi\gamma$ ionisation chamber. (27 refs.)

117549 Measurement of the beta-ray spectra of ^{90}Sr-^{90}Y. H.H.Hansen (Commission of the European Communities, Central Bur. for Nuclear Measurements, Geel, Belgium).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1241-7 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
The β-ray spectra of ^{90}Sr and ^{90}Y have been remeasured with the CBNM magnetic β-ray spectrometer. From the measurements the endpoint energies ($W_0[m_oc^2]$ and E_0[keV]), the spectrum shapes (coefficient, a, of the shape-correction factor, 1+aW), and the ratio of the numbers of β particles emitted in the decays of respectively ^{90}Y and ^{90}Sr, $(I_{\beta1}/I_{\beta2})$, have been determined. The results are for ^{90}Y, β_1 transition: $W_{01}=5.4608\pm0.0058$, $E_{01}=(2279.5\pm2.9)$ keV, $a_1=-(0.0078\pm0.0024)$; ^{90}Sr, β_2 transitions: $W_{02}=2.0685\pm0.0032$, $E_{02}=(546.0\pm1.6)$ keV, $a_2=-(0.032\pm0.007)$. The ratio of the numbers of emitted β particles is $I_{\beta1}/I_{\beta2}=1.00\pm0.01$. Corrections to the measured data and the estimates of uncertainties are discussed. (14 refs.)

117550 Measurements and evaluation of decay data of fission products. N.Coursol, F.Lagoutine, B.Chauvenet (Lab. de Metrologie des Rayonnements Ionisants, CENS, Gif-sur-Yvette, France).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1265-7 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
During the past ten years, the authors' institute has evaluated decay data for more than a hundred radionuclides, including twenty common fission products. The evaluation work in this field is still going on. Knowledge of decay data is of special interest for the calculation of nuclear-reactor decay heat. The recommended decay data for ^{125}Sb are given as an example. (7 refs.)

117551 Limit on Im (C_SC_A*) from a test of T invariance in ^{19}Ne beta decay. M.B.Schneider, F.P.Calaprice, A.L.Hallin, D.W.MacArthur, D.F.Schreiber (Dept. of Phys., Princeton Univ., Princeton, NJ, USA).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1239-42 (3 Oct. 1983).
An investigation of the time-reversal-odd angular correlation $\hat{\sigma}.(\hat{J}\times\vec{p}/E)$ in ^{19}Ne β decay is reported. In this correlation, $\hat{\sigma}$, $\vec{p}$, and E are the β spin, momentum, and energy, respectively, and $\hat{J}$ is the initial ^{19}Ne spin. The sample was polarized by an atomic beam method and the β polarization was measured with four Mott-scattering polarimeters. The magnitude R of the angular correlation is found to be -0.079 ± 0.053, consistent with time-reversal invariance. This result also implies $\mathrm{Im}(C_SC_A^*)=0.19\pm0.13$. (14 refs.)

117552 New isomers and their decay in odd-odd neutron-deficient cesium isotopes. B.Weiss (Lab. de Radiochimie, Univ. de Nice, Nice, France), C.F.Liang, P.Paris, A.Peghaire, A.Gizon.
Z. Phys. A (Germany), vol.313, no.3, p.173-87 (1983).
By a systematic on-line cesium mass separation from $A=122$ to $A=132$ and subsequent gamma and electron decay spectroscopy at very low energy, new isomers have been precisely identified: ^{122m}Cs ($T_{1/2}=0.36\pm0.02$ s), ^{124m}Cs ($T_{1/2}=6.3\pm0.2$ s) and ^{130m}Cs ($T_{1/2}=3.46\pm0.06$ min). Detailed level schemes are given for both ^{124m}Cs and ^{130m}Cs. Comparison of excited levels known in the odd-odd nuclei of the same region shows that more experimental informations are needed to propose a clear and realistic picture of the nuclear states structure. (36 refs.)

117553 The estimation of β-delayed two-neutron emission probability in the $A\geq50$ region. Yu.S.Lyutostansky (Moscow Phys.-Engng. Inst., Moscow, USSR), I.V.Panov.
Z. Phys. A (Germany), vol.313, no.3, p.235-8 (1983).
The probability of recently discovered β-delayed two-neutron emission is calculated using the microscopic model based on the finite Fermi systems theory. For nuclei of ^{50,51,52}K, ^{86}As, ^{92}BR, ^{91}Se, ^{98,99,100}Rb, ^{132}In, ^{136}Sb with measured half-lives predictions are made. The effect of the β-strength function structure on β-delayed two-neutron emission probability in the continuous part of the spectrum is discussed. (11 refs.)

117554 Half-lives of the neutron-rich isotopes ^{100}Sr, ^{100}Y, ^{148}Ba and ^{148}La. J.Munzel (II. Phys. Inst., Univ. Giessen, Giessen, Germany), B.Pfeiffer, H.Wollnik.
Z. Phys. A (Germany), vol.313, no.3, p.247-8 (1983).
Using a high-temperature ion source at the fission product separator OSTIS the authors determined the half-lives of ^{100}Sr (214 ± 8 ms), ^{100}Y (682 ± 18 ms), ^{148}Ba (672 ± 7 ms) and ^{148}La (1.34 ± 0.02 s) by γ-multispectra measurements. (8 refs.)

117555 Beta-decay energy and nuclear mass of ^{100}Nb. U.Keyser, F.Munnich, B.Pahlmann (Inst. fur Metallphys. und Nukleare Festkorperphys., Tech. Univ. Braunschweig, Braunschweig, Germany), B.Pfeiffer, H.Weikard.
Z. Phys. A (Germany), vol.313, no.3, p.251-2 (1983).
The Q_β-value of ^{100}Nb has been measured at the mass separator OSTIS in order to resolve discrepancies between the results of β-decay and reaction studies concerning the mass of this nucleus. From 9 experimental β-endpoint energies, a consistent Q_β-value of 6250 ± 35 keV has been obtained, in agreement with earlier β-spectroscopic studies. This result confirms that the nucleus ^{100}Nb belongs to a transition region between spherical and deformed nuclear shape. (11 refs.)

Revision of the evaluated UKCNDC Activation-Product Decay-Data Library ....See Entry 116933

Rutherford and beta decay ....See Entry 116947

Further experimental test of nucleon charge conservation through the reaction ^{13}Cd$\longrightarrow^{113m}$In+neutrals ....See Entry 117460

Half-life measurements at the PTB ....See Entry 117542

Half-life measurements of excited levels in the nanosecond and microsecond region ....See Entry 117543

The IAEA coordinated research programme on the measurement and evaluation of transactinium-isotope nuclear decay data ....See Entry 117556

23.60 ALPHA DECAY

117556 The IAEA coordinated research programme on the measurement and evaluation of transactinium-isotope nuclear decay data. R.Vaninbroukx (Commission of the European Communities, Central Bur. for Nuclear Measurements, Geel, Belgium).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1259-64 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
In 1977 the Nuclear Data Section of the Atomic Energy Agency organized a coordinated research programme on the measurement and evaluation of transactinium-isotope nuclear decay data. The objectives of the coordinated research programme, its organisation, the achievements and the ongoing work are reported. (28 refs.)

117557 Evaluation of non-neutron nuclear data for the ^{226}Ra decay-chain. N.Coursol, F.Lagoutine (Lab. de Metrologie des Rayonnements Ionisants, CENS, Gif-sur-Yvette, France).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1269-75 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
The importance of evaluating natural chains is discussed; some recommended data and related uncertainties are given for the following parameters: half lives, energies and emission probabilities of various radiations for ^{226}Ra in radioactive equilibrium with its daughter products. (16 refs.)

Revision of the evaluated UKCNDC Activation-Product Decay-Data Library ....See Entry 116933

Half-life measurements at the PTB ....See Entry 117542

Half-life measurements of excited levels in the nanosecond and microsecond region ....See Entry 117543

23.90 OTHER TOPICS IN NUCLEAR DECAY AND RADIOACTIVITY

117558 Experiments for the investigation of ground-state proton radioactivity. S.Hofmann (Gesellschaft fur Schwerionenforschung, Darmstadt, Germany).
Atomkernenerg. Kerntech. (Germany), vol.42, no.3, p.157-64 (1983). In German.
Ground-state proton radioactivity has been observed in experiments at the velocity separator SHIP and at the mass separator online to the UNILAC accelerator. The activities have been observed in the reactions $^{58}Ni+^{96}Ru\rightarrow^{154}Hf^*$ and $^{58}Ni+^{92}Mo\rightarrow^{150}Yb^*$ and could be assigned to ^{151}Lu and ^{147}Tm respectively. The decay properties can be described with a simple transmission model for protons and spectroscopic data from shell model considerations. (40 refs.)

24.00 NUCLEAR REACTIONS AND SCATTERING: GENERAL

24.10 NUCLEAR REACTION AND SCATTERING MODELS AND METHODS

117559 A study of *Q*-value effects on barrier penetration. C.H.Dasso, S.Landowne (Nordita, Copenhagen, Denmark), A.Winther.
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.221-32 (3-10 Oct. 1983).
Coupled-channel equations for barrier penetration problems are solved anlytically to show the effects which finite Q-values have on the total transmission function. (8 refs.)

117560 Jacobian free global event analysis. P.Danielewicz, M.Gyulassy (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Phys. Lett. B (Netherlands), vol.129B, no.5, p.283-8 (29 Sept. 1983).
Conventional global event analysis using the sphericity tensor is shown to be biased against shapes with degenerate radii and vanishing flow angles for multiplicities $M<100$. The jacobian responsible for the bias is computed analytically. The authors construct a jacobian free distribution that eliminates most of the $O(1/\sqrt{M})$ distortions. Finally, an azimuthally corrected sphericity matrix is shown to be useful in searching for collective flow phenomena in nuclear collisions. (11 refs.)

117561 On determination of duration of nuclear reactions with charged particles and γ-rays. V.S.Olkhovskii.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1319-23 (Sept. 1983). In Russian.
Determination of durations of nuclear reactions with charged particles and γ-rays is generalized. It is shown that the scattering duration in the threshold range is a finite and continuous function of the energy if the lifetime finiteness of excited target nucleus states is taken into account. It is established under what condition the scattering durations in the threshold range can grow up to maximum values determined by widths of the target nucleus excited states. (9 refs.)

117562 Friction coefficients for deep inelastic heavy-ion collisions. S.Yamaji (Inst. of Phys. & Chem. Res., Saitama, Japan), A.Iwamoto.
Z. Phys. A (Germany), vol.313, no.3, p.161-6 (1983).
The friction coefficients for deep inelastic collisions are re-evaluated microscopically in the framework of the linear response theory, adopting the cutoff procedure of Jensen et al. (1982) to take account of lifetime of particle-hole excitations. They have the same order of magnitude as the previous ones with a constant time cutoff parameters. (14 refs.)

A sum rule approach to effective charges in electromagnetic knock-out reactions .... See Entry 117565

Inclusive (p,p′) reactions at medium energies .... See Entry 117571

A study of the (^6Li,^7Be) reaction in the mass-90 region at 60 MeV .... See Entry 117582

Elastic fusion and total reaction cross-sections for the $^{12}C+^{32}S$ system at $E(^{32}S)=160$ MeV .... See Entry 117583

Unified band-crossing interpretation of $^{16}O+^{16}O$ inelastic reactions .... See Entry 117587

24.10H Optical and diffraction models

Slopes, coherence and compositeness in high-energy collisions with nuclei .... See Entry 117496

Curium-248 neutron data evaluation .... See Entry 117573

A study of the (^6Li,^7Be) reaction in the mass-90 region at 60 MeV .... See Entry 117582

24.30 RESONANCE REACTIONS AND SCATTERING

117563 Resonance parameters of the two low-energy iridium resonances. P.Fischer, U.Harz, H.G.Priesmeyer (Inst. fur Reine und Angewandte Kernphys., Univ. Kiel, Kiel, Germany).
Atomkernenerg. Kerntech. (Germany), vol.42, no.3, p.203 (1983).
Uses U-238 levels for spectrometer calibration, to determine the Ir-191 and Ir-193 resonance energies in relation to this standard. (4 refs.)

117564 Self-consistent calculations of nuclear response for closed-shell nuclei. J.Decharge, L.Sips (Service de Phys. Neutronique et Nucleaire, Centre d'Etudes de Bruyeres-le-Chatel, Montrouge, France).
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.1-28 (3-10 Oct. 1983).
A fully self-consistent calculation of nuclear response in the giant resonance region for closed-shell nuclei ^{16}O through ^{208}Pb is presented. The finite-range density-dependent interaction D1 has been utilized. Particular attention has been given to the momentum transfer dependence and thus the electromagnetic transition operator exp $(iq.r)$ has been considered. Corresponding energy-weighted sum rules have been evaluated to ascertain the relevance of the calculated response. The correctness of transition densities for known resonances has made it possible to suggest the existence of several other resonances in the higher frequency region presently accessible experimentally. (43 refs.)

Measurement of the total neutron cross-section of selenium at neutron energies below 2 eV .... See Entry 117566

24.50 DIRECT REACTIONS

Proton correlations and the missing M1 strength in ^{48}Ca: a two-state model .... See Entry 117540

A sum rule approach to effective charges in electromagnetic knock-out reactions .... See Entry 117565

24.60 STATISTICAL THEORY AND FLUCTUATIONS

Isotopic effects in the (*n,p*) reaction cross section on he;avy targets and the statistical preequilibrium model .... See Entry 117572

Curium-248 neutron data evaluation .... See Entry 117573

The even-odd effect of the pre-equilibrium emission in ^{59}Co, ^{60}Ni, ^{63}Cu, ^{64}Zn (α,p) reactions .... See Entry 117578

24.70 POLARIZATION IN REACTIONS AND SCATTERING

The general structure of polarization characteristics in deuteron electrodsintegration .... See Entry 117477

Investigation of the $^{48}Ti(n,\gamma)^{49}Ti$ reaction .... See Entry 117569

Inclusive (p,p′) reactions at medium energies .... See Entry 117571

Kinematically complete measurement of cross sections and vector and tensor analyzing powers of $^4He(\vec{d},p\alpha)n$ at $E_{\vec{d}}=10$ MeV .... See Entry 117577

Spin-orbit potentials for elastic scattering of polarized ^6Li ions from ^{12}C and ^{58}Ni .... See Entry 117584

Energy dependence of the tensor polarisation t_{20} in π^+-d elastic scattering .... See Entry 117590

24.75 GENERAL PROPERTIES OF FISSION

Investigation of fission models for high-energy radiation transport calculations .... See Entry 117703

25.00 NUCLEAR REACTIONS AND SCATTERING: SPECIFIC REACTIONS

25.10 NUCLEAR REACTIONS AND SCATTERING INVOLVING FEW-NUCLEON SYSTEMS

Soft repulsive core effects in the d+d scattering and reaction .... See Entry 117574

Investigation of the $^1H(d,pp)n$ reaction in collinear geometry at 12.8, 14.2 and 15.6 MeV .... See Entry 117576

Kinematically complete measurement of cross sections and vector and tensor analyzing powers of $^4He(\vec{d},p\alpha)n$ at $E_{\vec{d}}=10$ MeV .... See Entry 117577

25.20 PHOTONUCLEAR REACTIONS AND PHOTON SCATTERING

117565 A sum rule approach to effective charges in electromagnetic knock-out reactions. S.Roffi, C.Giusti, F.D.Pacati (Dipartimento di Fisica Nucleare, Univ. di Pavia, Pavia, Italy), M.Rosa-Clot.
Nuovo Cimento A (Italy), vol.76A, ser.2, no.4, p.685-98 (21 Aug. 1983).
Centre-of-mass motion and exchange effects can be considered in nuclear knock-out by real and/or virtual photons by means of effective charges in order to retain the attractive feature of single-particle transitions. These effective charges are obtained by splitting the energy-weighted sum rule for the charge operator into a proton and a neutron contribution. The q-dependence of such effective charges is investigated for several nuclei. As $q\rightarrow0$ the dipole limit is recovered, while for $q\rightarrow\infty$ one obtains the quasi-free scattering limit. A simple model is used for the exclusive reaction both with real and virtual photons to define the corresponding effective charges which are more sensitive to the details of the reaction kinematics. The ratio e_p^2/e_n^2 is in agreement with the $(\gamma,p)/(\gamma,n)$ data. (22 refs.)

25.30 LEPTON-INDUCED REACTIONS AND SCATTERING

The general structure of polarization characteristics in deuteron electrodsintegration .... See Entry 117477

25.40 NUCLEON-INDUCED REACTIONS AND SCATTERING

(see also 28.20 Neutron physics)

117566 Measurement of the total neutron cross-section of selenium at neutron energies below 2 eV. M.Salama (Nuclear Res. Center, Atomic Energy Establ., Cairo, Egypt).
Atomkernenerg. Kerntech. (Germany), vol.42, no.3, p.187-9 (1983).
Total neutron cross-section of ordinary selenium has been measured at room temperature as a function of neutron energy in the range from 2.2 eV to 5.5 meV. The measurements were performed using the transmission method in connection with a time-of-flight spectrometer installed in front of one of the horizontal channels of the ER-RR-1 reactor. Expression for the dependence of the total neutron cross-section of selenium upon energy was obtained. New values for the coherent scattering amplitude as well as the coherent scattering cross-section of selenium were also determined. Values for the average scattering cross-section and the total incoherent scattering cross-section were also obtained. The values of both potential scattering cross-section and effective potential scattering radius R' were determined for this element from the measured behaviour of the total cross-section, using the single level Breit-Wigner formula. The determined value of R' was found to be in agreement

with that predicted from vibrational-rotational optical model calculations. (18 refs.)

117567 **Quasi-free reaction ^{12}C(p,d^{3}He)^{8}Be.** Liu Xianhui (Inst. of High Energy Phys., Acad. Sinica, Beijing, China), Chen Xuejun.
Chin. J. Nucl. Phys. (USA), vol.5, no.3, p.249-53 (Aug. 1983). In Chinese.
Based on the independent particle model of α-cluster the wave functions of the relative motion between α-cluster and ^{8}Be-cluster in nucleus ^{12}C are reduced, and then the energy sharing spectra of the quasi-free reactions ^{12}C (p,d^{3}He)^{8}Be at the bombarding energy of 100 MeV are calculated by PWIA and DWIA. The results obtained are in good agreement with the experimental data. (11 refs.)

117568 **The determination of forward and backward average projectional recoil ranges in the ^{65}Cu(n,2n)^{64}Cu and ^{27}Al(n,α)^{24}Na reactions induced by D-T neutrons.** Guo Yinghuan, Zhao Zhenlan, Zhang Jinglie, Luo Shihua, Huang Zhongxiang, Yang Ruiying, Jiang Yong, Feng Xizhang (Inst. of High Energy Phys., Acad. Sinica, Beijing, China).
He Huaxue Yu Fangshe Huaxue (China), vol.4, no.4, p.234-7 (Nov. 1982). In Chinese. [received: Sept. 1983]
In this work, the forward and backward average projectional recoil ranges (R) of the residual ^{64}Cu and ^{24}Na with respect to neutron beam direction respectively in the ^{65}Cu(n,2n)^{64}Cu and ^{27}Al(n,α)^{24}Na reactions induced by D-T neutrons were determined by thick-target-thick-catcher method. The results are $R_F=73.8\pm13.1$ μg/cm^2, $R_B=10.0\pm5.1$ μg/cm^2 for ^{64}Cu in Cu-target and $R_F=282.9\pm11.0$ μg/cm^2, $R_B=20.0\pm3.4$ μg/cm^2 for ^{24}Na in Al-target. (13 refs.)

117569 **Investigation of the ^{48}Ti(n,γ)^{49}Ti reaction.** J.F.A.G.Ruyl (FOM-ECN, Netherlands Energy Res. Found., Petten, Netherlands), P.M.Endt.
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.60-76 (3-10 Oct. 1983).
The energy E_γ and the intensity I_γ of 97 γ-rays produced by capture of thermal neutrons in ^{48}Ti have been measured. Of the total observed strength 99.6% has been placed in the decay scheme which consists of 78 transitions between 28 levels. The Q-value of 8142.41(3) keV is in agreement with previous data. From a measurement of the γ-ray circular polarization resulting from the capture of polarized neutrons, combined with previous (d,p) work, the spins of 5 levels could be determined, and those of 13 other levels could be confirmed. The primary strength to 2p states agrees with a sum rule estimate. The nature of the capture process was determined as valence capture. The total cross-section estimate agrees with experiment. The total number of $J^\pi=(^1/_2\text{-}^5/_2{}^-)$ levels below $E_x=3.8$ MeV and the resonance level density are explained satisfactorily by the Fermi gas model. (25 refs.)

117570 **A study of ^{206}Pb by inelastic scattering of 35 MeV protons.** J.E.Finck (Dept. of Phys., Northern Michigan Univ., Marquette, MI, USA), G.M.Crawley, J.A.Nolen,Jr., R.T.Kouzes.
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.163-92 (3-10 Oct. 1983).
Using high-resolution techniques the inelastic scattering of 35 MeV protons by ^{206}Pb was measured. Approximately 180 levels with excitation energies up to 6.8 MeV were identified and angular distributions of most of these states were measured. The L-transfers and deformation parameters were determined by comparison of the measured angular distributions to collective-model calculations. Microscopic calculations of natural-parity states are presented and allow a test of RPA and TDA wave functions. Unnatural-parity states were also studied microscopically and permit an examination of the central and noncentral forces in the effective interaction. (29 refs.)

117571 **Inclusive (p,p′) reactions at medium energies.** Y.Tzeng, T.Tamura (Dept. of Phys., Univ. of Texas, Austin, TX, USA).
Phys. Lett. B (Netherlands), vol.129B, no.6, p.379-83 (6 Oct. 1983).
By extending the formalism of Krimm et al. (1981) so that spin-dependent amplitudes can be used in the multiple-scattering treatment of the A(p,p′)X reactions, ^{12}C(p,p) dat at $E_p=800$ MeV were analyzed. Reasonably good fits to data were obtained for both cross sections and analyzing powers. (6 refs.)

117572 **Isotopic effects in the (n,p) reaction cross section on he;avy targets and the statistical preequilibrium model.** R.Caplar, L.Udovicic, E.Holub, D.Pocanic, N.Cindro (Rudjer Boskovic Inst., Zagreb, Yugoslavia).
Z. Phys. A (Germany), vol.313, no.3, p.227-34 (1983).
The systematic decrease in (n,p) cross sections with increasing neutron number for isotopes in reactions induced by 14 MeV neutrons on heavy targets is explained in terms of the preequilibrium model. The relevant physical quantities responsible for this behaviour are proton and neutron separation energies, similarly to (n,p) reactions on lighter nuclei, in which proton emission is governed by the compound-nucelus model. The principal transition rate λ_+ in the preequilibrium exciton-model calculations should be kept constant (for a given number of excitons and constant energy) in order to obtain a good description of data. The calculations are compared with experimental (n,p) cross sections for series of Te, Xe, W and Os isotopes. (25 refs.)

117573 **Curium-248 neutron data evaluation.** M.Caner, S.Yiftah.
Report IA-1383, Israel Atomic Energy Comm., Tel Aviv (Feb. 1983), iii+35 pp.
An evaluation of ^{248}Cm neutron data was performed. All significant cross sections in the neutron energy range 10^{-3} to 15×10^{6} eV were considered. The experimental data were complemented by spherical optical model and statistical theory calculations. The evaluated data were compared with those in the ENDF/B-V file. (32 refs.)

The constancy of the laws of physics in the light of prehistoric nuclear reactors ....See Entry 116944

Structure information n ^{38}K obtained from a microscopic and macroscopic DWBA analysis of the ^{40}Ca(p,^{3}He)^{38}K reaction ....See Entry 117521

Low-lying states of the ^{102}Rh nucleus ....See Entry 117524

Resonance parameters of the two low-energy iridium resonances ....See Entry 117563

Measurement of the prompt fission neutron multiplicity from the ^{245}Cm(n,f) and ^{242}Am(n,f) reactions ....See Entry 117592

25.50 ^{2}H- AND ^{3}H-INDUCED REACTIONS AND SCATTERING

117574 **Soft repulsive core effects in the d+d scattering and reaction.** Zhao Xuan, Zeng Fanan (Inst. of Nuclear Res., Acad. Sinica, Shanghai, China).
Chin. J. Nucl. Phys. (USA), vol.5, no.3, p.239-48 (Aug. 1983). In Chinese.
By using the one-channel RGM in which a central nucleon-nucleon potential containing a soft repulsive core (SRC) is adopted, the authors have calculated the d+d scattering phase shifts, differential scattering cross sections and total reaction cross sections at a series of energies below 20 MeV with and without imaginary potential. The agreement between the theoretical and experimental results is good. The main conclusions are as follows: (a) the phase shifts calculated with SRC are lower than that calculated without repulsive core (RC); (b) the SRC makes the total reaction cross sections decrease distinctly and makes the differential scattering cross sections at the forward and backward angle increase distinctly, but it does not have large influence upon the differential cross sections at other angles; (c) the SRC has some marked effects on the d+d scattering phase shifts, differential cross sections and total reaction cross sections. (13 refs.)

117575 **On the determination of the deuteron quadrupole moment by elastic scattering of polarised deuterons.** J.E.Kammeraad, L.D.Knutson (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).
J. Phys. G (GB), vol.9, no.10, p.L217-22 (Oct. 1983).
It is shown that the deuteron quadrupole moment can be determined from measurements of the tensor analysing power T_{20} for sub-Coulomb deuteron elastic scattering. A first result, $Q=0.282\pm0.019$ fm^2, is obtained from measurements of T_{20} for ^{208}Pb(d,d) at a deuteron energy of 4 MeV. (14 refs.)

117576 **Investigation of the ^{1}H(d,pp)n reaction in collinear geometry at 12.8, 14.2 and 15.6 MeV.** D.L.Chuprunov, M.S.Golovkov, S.N.Kondratyev, T.N.Mikhaleva, A.M.Popova, V.V.Zatekin (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
J. Phys. G (GB), vol.9, no.10, p.1199-210 (Oct. 1983).
Differential cross sections have been measured for the ^{1}H(d,pp)n reaction in collinear and non-collinear geometry at incident deuteron energies of 15.6, 14.2 and 12.8 MeV. The results are compared with an exact three-body calculation by using two-particle charge-dependent interactions for the S wave. The calculations fit the experimental data. (13 refs.)

117577 **Kinematically complete measurement of cross sections and vector and tensor analyzing powers of ^{4}He($\vec{d}$,pα)n at $E_{\vec{d}}=10$ MeV.** M.Bruno, F.Cannata, M.D'Agostino (Istituto di Fisica, Univ. di Bologna, Bologna, Italy), B.Jenny, W.Gruebler, V.Konig, P.A.Schmelzbach, P.Doleschall.
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.29-44 (3-10 Oct. 1983).
Differential cross sections and vector and tensor analyzing powers have been measured in the breakup reaction ^{4}He($\vec{d}$,pα)n at $E_{\vec{d}}=10$ MeV, for $\theta_\alpha=46°$, $\theta_p=46°$ in a kinematically complete coincidence experiment. The kinematics allow for np final-state interaction (FSI) (E_{np}=O). A comparison with theoretical predictions based on Faddeev equations is presented. Phenomenologically it appears that there are larege interference effects between the different FSI and the importance of Coulomb interaction emerges clearly. (29 refs.)

25.60 ^{3}HE- AND ^{4}HE-INDUCED REACTIONS AND SCATTERING

117578 **The even-odd effect of the pre-equilibrium emission in ^{59}Co, ^{60}Ni, ^{63}Cu, ^{64}Zn (α,p) reactions.** Lu Xiuqin, Cheng Yehao, Yang Zhuqing, Zhao Kui, Zhu Guanghua, Jiang Chenglie (Inst. of Atomic Energy, Acad. Sinica, Beijing, China).
Chin. J. Nucl. Phys. (USA), vol.5, no.3, p.193-202 (Aug. 1983). In Chinese.
The energy spectra of protons emitted in the ^{63}Cu (α,p), ^{64}Zn (α,p), ^{60}Ni (α,p) reactions are measured at $E_\alpha=18$ MeV. It is found that the fractions of pre-equilibrium emission in odd-A target cases are larger than in even-even target cases. The experimental results are analyzed using exciton model. The even-odd effect about the pre-equilibrium emission in ^{59}Co, ^{60}Ni, ^{63}Cu, ^{64}Zn (α,p) reactions is discussed in detail. The fraction of the pre-equilibrium emission depends strongly on the related binding energies and pairing energies, and these energies depend systematically on the nucleus. The even-odd effect in the (α,n) reactions and other related problems are also discussed. (14 refs.)

117579 **Band structure in ^{81}Sr.** S.E.Arnell, C.Ekstrom (Dept. of Phys., Chalmers Univ. of Technol., Gothenburg, Sweden), L.P.Ekstrom, A.Nilsson, I.Ragnarsson, P.J.Smith, E.Wallander.
J. Phys. G (GB), vol.9, no.10, p.1217-35 (Oct. 1983).
The reactions ^{78}Kr(α,n) and ^{80}Kr(α,3n) were used to populate excited states in ^{81}Sr. The de-excitation of these states was studied by in-beam γ-ray spectroscopy. A number of new high-spin states forming band structures have been observed. Lifetime measurements have also been performed. Theoretical calculations using a particle-rotor approach based on the Nilsson model have been made. The different bands are generally well reproduced. (35 refs.)

117580 **Low-lying levels in ^{125}Xe and ^{127}Xe.** A.D.Irving, P.D.Forsyth, I.Hall, D.G.E.Martin (Oliver Lodge Lab., Univ. of Liverpool, Liverpool, England).
J. Phys. G (GB), vol.9, no.10, p.1245-69 (Oct. 1983).
The nuclei ^{125}Xe and ^{127}Xe have been studied by the ^{122}Te(α,n)^{125}Xe, ^{124}Te(α,n)^{127}Xe, ^{125}Te(α,2n)^{127}Xe and ^{123}Sb(^{7}Li,3n)^{127}Xe reactions. In-beam γ-ray spectroscopy measurements largely confirm the level schemes and band structures proposed earlier for these nuclei. The results are compared with recent theoretical calculations and appear to be in good overall agreement with those based on the interacting boson-fermion model, though the electromagnetic decay properties suggest that refinements in the calculations are required. (33 refs.)

117581 **In-beam investigation of high-spin states in actinides with (α,xn) compound reactions.** K.Hardt, P.Schuler, C.Gunther, J.Recht, K.P.Blume (Inst. fur Strahlen- und Kernphys., Univ. Bonn, Bonn, Germany).
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.127-40 (3-10 Oct. 1983).
The ground-state rotational bands in ^{230,232}U and ^{236,238,240}Pu were investigated in (α,xn) reactions. Conversion electrons mere measured with an iron-free orange spectrometer in order to suppress the background from fission. Levels up to $I^\pi\approx16^+$ were identified in e$^-\gamma$ coincidence measurements. The systematics of the ground-state rotational bands in the even actinides is discussed. (24 refs.)

Electromagnetic transitions and radiative capture in the generator-coordinate method ....See Entry 117528

25.70 HEAVY ION INDUCED REACTIONS AND SCATTERING

117582 **A study of the (^{6}Li,^{7}Be) reaction in the mass-90 region at 60 MeV.** R.Wadsworth, M.D.Cohler, M.J.Smithson, D.L.Watson (Postgraduate School of Phys., Univ. of Bradford, Bradford, England), F.Jundt, L.Kraus, I.Linck, J.C.Sens.
J. Phys. G (GB), vol.9, no.10, p.1237-44 (Oct. 1983).
Angular distributions have been measured for the reactions ^{90}Zr(^{6}Li,^{7}Be$_{GS}$)^{89}Y, ^{90}Zr(^{6}Li,^{7}Be$_{0.43}$)^{89}Y, ^{89}Y(^{6}Li,^{7}Be$_{GS}$)^{88}Sr and ^{89}Y(^{6}Li,^{7}Be$_{0.43}$)^{88}Sr at an incident beam energy of 60 MeV in the angular range 6°-45° (lab). Exact finite-range distorted-wave Born approximation calculations have been performed and were found to be moderately successful in

reproducing the shape of the experimental angular distribution. The optical-model parameters used in the calculations were obtained from a global set of parameters which was capable of reproducing the ^{6}Li and ^{7}Li elastic scattering data taken at 60 MeV. In the analysis of the reaction data the $^7Be_{GS}$ was assumed to be a mixed state of $1p_{3/2}$ and $1p_{1/2}$ configurations, whilst the $^7Be_{0.43}$ state was assumed to be due to a pure $1p_{3/2}$ configuration, in agreement with shell-model calculations and previous experimental results. Spectroscopic factors were deduced from a comparison of the theoretical and experimental cross sections. The results obtained were found to be in good agreement with those deduced from light-ion reactions. (13 refs.)

117583 Elastic fusion and total reaction cross-sections for the $^{12}C+^{32}S$ system at $E(^{32}S)=160$ MeV. R.Giordano, F.Porto, S.Sambataro, A.Scalia (Istituto Dipartimentale di Fisica, Univ. Catania, Catania, Italy).
Nuovo Cimento A (Italy), vol.77A, ser.2, no.2, p.135-46 (21 Sept. 1983).
Elastic scattering, evaporation residues and total reaction cross sections have been measured for the system $^{12}C+^{32}S$ and $E(^{32}S)=160$ MeV. The total reaction cross-section has been also extracted by means of the modified SOD method. The experimental results have been interpreted in the light of a simple model underlying the method. (11 refs.)

117584 Spin-orbit potentials for elastic scattering of polarized ^{6}Li ions from ^{12}C and ^{58}Ni. K.Rusek, Z.Moroz (Inst. of Nuclear Res., Warsaw, Poland), R.Caplar, P.Egelhof, K.-H.Mobius, E.Steffens, I.Koenig, A.Weller, D.Fick.
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.208-20 (3-10 Oct. 1983).
Angular distributions of the differential cross section σ/σ_R, of the vector analyzing power iT_{11} and of the 2nd rank tensor analyzing power $^TT_{20}$ have been measured for elastic scattering of ^{6}Li from ^{12}C and ^{58}Ni at 19.2 and 20.0 MeV, respectively. The vector and tensor polarization data can be well described using in addition to the complex central potential a real spin-orbit potential. Best-fit potentials are compared with those from folding models. In addition, vector analyzing power data were measured for ^{6}Li-^{122}C elastic scattering at 9.0 MeV bombarding energy. They are compared to predictions derived from an analysis of previously measured tensor analyzing powers of the same system at the same energy. (22 refs.)

117585 Linear momentum transfer investigated in the $^{20}Ne+^{197}Au$ and ^{209}Bi systems at 30 MeV/u. G.La Rana, G.Nebbia, E.Tomasi, C.Ngo, X.S.Chen, S.Leray, P.Lhenoret, R.Lucas, C.Mazur, M.Ribrag (CENS, Gif-sur-Yvette, France), C.Cerruti, S.Chiodelli, A.Demeyer, D.Guinet, J.L.Charvet, M.Morjean, A.Peghaire, Y.Pranal, L.Sinopoli, J.Uzureau, R.de Swiniarski.
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.233-54 (3-10 Oct. 1983).
The authors have measured at SARA the correlation of fission fragments produced in the reactions $^{20}Ne+^{197}Au$ and $^{20}Ne+^{209}Bi$ at 30 MeV/u. The results show that the most probable amount of linear momentum transferred from the projectile to the fissioning nucleus is about 80%. This corresponds to about 3.7 GeV/*c*. The fission cross section is still rather large at this bombarding energy: 1.6 ± 0.3 b for the Au target and 2.2 ± 0.5 b for the Bi one. They present the results of a Monte-Carlo simulation which allows them to reproduce most of the experimental data under certain conditions which are discussed. (17 refs.)

117586 Collisions to melt the vacuum. B.Willis (CERN, Geneva, Switzerland).
New Sci. (GB), vol.100, no.1378, p.9-12 (6 Oct. 1983).
Physicists now believe that they can create a new form of vacuum, resembling that of the early stages of the Universe. Far from being empty, this new vacuum is seething with elementary quarks and gluons. It may possibly be formed in collisions of high-energy nuclei. (no refs.)

117587 Unified band-crossing interpretation of $^{16}O+^{16}O$ inelastic reactions. K.Langanke, H.Friedrich, S.E.Koonin (W.K. Kellogg Radiation Lab., California Inst. of Technol., Pasadena, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1231-4 (3 Oct. 1983).
A band-crossing model based on a microscopically derived $^{16}O+^{16}O$ potential and the Pauli principle is used to interpret data on $^{16}O+^{16}O$ reactions to eight inelastic channels. Structures observed in the cross sections are accounted for in all cases. (16 refs.)

117588 Resonances in elastic and inelastic scattering of $^{24}Mg+^{24}Mg$. R.W.Zurmuhle, P.Kutt (Dept. of Phys., Univ. of Pennsylvania, Philadelphia, PA, USA), R.R.Betts, S.Saini, F.Haas, O.Hansen.
Phys. Lett. B (Netherlands), vol.129B, no.6, p.384-6 (6 Oct. 1983).
Excitation functions for elastic and inelastic scattering of $^{24}Mg+^{24}Mg$ have been measured in 100 keV steps over the bombarding energy range 84-100 MeV. Strong narrow resonances are observed correlated in many channels. The data are compared with similar results for the $^{28}Si+^{28}Si$ system. (6 refs.)

117589 Pairing effects in quasi-elastic neutron transfer between tin isotopes. W.von Oertzen, B.Gebauer, A.Gamp, H.G.Bohlen (Hahn-Meitner-Inst. fur Kernforschung, Berlin, Germany), F.Busch, D.Schull.
Z. Phys. A (Germany), vol.313, no.3, p.189-95 (1983).
The transfer of neutrons between low-lying states of Tin isotopes has been measured in the reaction $^{120}Sn\rightarrow^{112}Sn$ at energies below the Coulomb barrier. The transfer probabilities are deduced as function of the classical minimum distance from transfer and scattering cross sections at different angles and two energies. At the smallest distances very large transfer probabilities, $P_t=0.5$, are observed for one- and two-neutron transfer. The two-neutron transfer is significantly enhanced as compared to a successive independent single-nucleon transfer. The definition of enhancement is discussed. (16 refs.)

Excited states in ^{128}Ba ....See Entry 117525

Experiments for the investigation of ground-state proton radioactivity ....See Entry 117558

A study of *Q*-value effects on barrier penetration ....See Entry 117559

Friction coefficients for deep inelastic heavy-ion collisions ....See Entry 117562

Low-lying levels in ^{125}Xe and ^{127}Xe ....See Entry 117580

Low-energy fusion of $^{28}Si+^{12}C$ ....See Entry 117593

25.80 MESON- AND HYPERON-INDUCED REACTIONS AND SCATTERING

117590 Energy dependence of the tensor polarisation t_{20} in $\pi^+ -d$ elastic scattering. V.Konig (Lab. fur Kernphys., Eidgenossische Tech. Hochschule, Zurich, Switzerland), A.Chisholm, W.Gruebler, J.Ulbricht, P.A.Schmelzbach, M.Merdzan, K.Elsener.
J. Phys. G (GB), vol.9, no.10, p.L211-15 (Oct. 1983).
The tensor polarisation t_{20} of the recoil deuterons from $\pi^+ -d$ elastic scattering has been measured between $T_\pi=110$ and 150 MeV. An excitation curve of t_{20} shows a clear peak near the mass 2.14 GeV with a structure 20 MeV wide. The angular distributions at 117, 134 and 151 MeV confirm the rapidly changing behaviour with energy. A phase-shift analysis of all $\pi^+ -d$ scattering data in this energy range has been performed. The strong energy and angular dependence are believed to manifest evidence for non-conventional dynamics. (8 refs.)

25.85 FISSION REACTIONS

117591 The measurement of absolute fission product yield for spontaneous fission of ^{252}Cf. Li Ze, Liu Conggui, Lu Huijun, Liu Yonghui, Wang Lianbi (Inst. of Atomic Energy, Acad. Sinica, Beijing, China).
Chin. J. Nucl. Phys. (USA), vol.5, no.3, p.226-38 (Aug. 1983). In Chinese.
The absolute fission product yields for spontaneous fission of ^{252}Cf are measured by Ge(Li) γ-ray spectrum method. The catcher foil technique is used for the first time in the absolute measurement of fission yields. The collection efficiency of catcher foil for fission fragments is studied precisely. 44 chain yields from ^{85}Kr to ^{157}Eu are obtained. Fractional independent chain yields of ^{134}I and ^{135}Xe are determined. They are 0.268 ± 0.048 and 0.086 ± 0.012, respectively. The authors' results are compared with those given in the literature. (22 refs.)

117592 Measurement of the prompt fission neutron multiplicity from the ^{245}Cm(n,f) and ^{242}Am(n,f) reactions. R.E.Howe, R.M.White, J.C.Browne, J.H.Landrum, R.J.Dougan, R.W.Lougheed, R.J.Dupzyk (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Nucl. Phys. A (Netherlands), vol.A407, no.1-2, p.193-207 (3-10 Oct. 1983).
The prompt fission neutron multiplicity, $\bar{\nu}_p$, of ^{245}Cm was measured relative to that of ^{235}U using the neutron time-of-flight facility at the Lawrence Livermore National Laboratory (LLNL) 100 MeV electron linac. Incident neutron energies ranged from 0.05 eV to 14 MeV. In addition, a monoenergetic measurement of $\bar{\nu}_p$ for ^{245}Cm relative to ^{235}U was made at $E_n=14.1$ MeV using the LLNL Insulated Core Transformer (ICT) Neutron Source. Fission fragments were detected using a hemispherical ionization chamber containing ~200 μg of ^{245}Cm. A separate fission chamber contained 8.3 mg of ^{235}U. Fission neutrons were detected in liquid scintillators using pulse-shape discrimination to separate γ-rays from neutrons. The measurements reported here for ^{245}Cm are in agreement with each other and indicate an overall rate of increase in $\bar{\nu}_p$ with incident neutron energy which departs significantly from systematic trends. Interpretations are presented which suggest that these results are a consequence of changing fragment kinetic energies. Results from a concurrent measurement of $\bar{\nu}_p$ for ^{242m}Am at $E_n=14.1$ MeV are also included and agree with previously reported data. (17 refs.)

Measurements and evaluation of decay data of fission products ....See Entry 117550

Linear momentum transfer investigated in the $^{20}Ne+^{197}Au$ and ^{209}Bi systems at 30 MeV/u ....See Entry 117585

25.88 FUSION REACTIONS

117593 Low-energy fusion of $^{28}Si+^{12}C$. R.A.Racca, P.A.Deyoung, J.J.Kolata, R.J.Thornburg (Phys. Dept., Univ. of Notre Dame, Notre Dame, IN, USA).
Phys. Lett. B (Netherlands), vol.129B, no.5, p.294-7 (29 Sept. 1983).
Fusion cross sections have been measured for the $^{28}Si+^{12}C$ system over the energy range 60 MeV$\leq E(^{28}Si)\leq$90 MeV. Large structures in the total fusion yield are identified at $E_{cm}=19.6$, 20.6, 22.0, 23.9 and 25.1 MeV. Unlike most systems previously studied, the nucleon decay modes are largely responsible for these anomalies. The structures occur at successive integral values of angular momentum, but do not appear to correlate with known resonances in 180° elastic and inelastic scattering. (16 refs.)

27.00 PROPERTIES OF SPECIFIC NUCLEI LISTED BY MASS RANGES

27.10 A $\leq$ 5

The general structure of polarization characteristics in deuteron electrodsintegration ....See Entry 117477

The triton binding energy and nd-scattering lengths with account of a quark nucleon structure ....See Entry 117519

Soft repulsive core effects in the d+d scattering and reaction ....See Entry 117574

Investigation of the ^{1}H(d,pp)n reaction in collinear geometry at 12.8, 14.2 and 15.6 MeV ....See Entry 117576

Kinematically complete measurement of cross sections and vector and tensor analyzing powers of $^4He(\vec{d},p\alpha)n$ at $E_{\vec{d}}=10$ MeV ....See Entry 117577

Energy dependence of the tensor polarisation t_{20} in $\pi^+ -d$ elastic scattering ....See Entry 117590

27.20 6 $\leq$ A $\leq$ 19

Semi-microscopic calculation of trinucleon cluster states in ^{18}F and ^{18}O ....See Entry 117523

Electromagnetic transitions and radiative capture in the generator-coordinate method ....See Entry 117528

Light *p*-shell Δ-hypernuclei by the microscopic three-cluster model ....See Entry 117537

Lifetime of the 1.04 MeV 0^+, $T=1$ state in ^{18}F ....See Entry 117546

Limit on Im (C_SC_A*) from a test of T invariance in ^{19}Ne beta decay ....See Entry 117551

Quasi-free reaction $^{12}C(p,d^3He)^8Be$ ....See Entry 117567

Inclusive (p,p′) reactions at medium energies ....See Entry 117571

Elastic fusion and total reaction cross-sections for the $^{12}C+^{32}S$ system at $E(^{32}S)=160$ MeV ....See Entry 117583

Spin-orbit potentials for elastic scattering of polarized ^{6}Li ions from ^{12}C and ^{58}Ni ....See Entry 117584

Unified band-crossing interpretation of $^{16}O+^{16}O$ inelastic reactions ....See Entry 117587

Low-energy fusion of $^{28}Si+^{12}C$ ....See Entry 117593

27.30 $20 \leq A \leq 38$

Structure information n ^{38}K obtained from a microscopic and macroscopic DWBA analysis of the ^{40}Ca(p,^{3}He)^{38}K reaction .... See Entry 117521

Electromagnetic transitions and radiative capture in the generator-coordinate method .... See Entry 117528

The determination of forward and backward average projectional recoil ranges in the ^{65}Cu(n,2n)^{64}Cu and ^{27}Al(n,α)^{24}Na reactions induced by D-T neutrons .... See Entry 117568

Resonances in elastic and inelastic scattering of ^{24}Mg+^{24}Mg .... See Entry 117588

27.40 $39 \leq A \leq 58$

Structure information n ^{38}K obtained from a microscopic and macroscopic DWBA analysis of the ^{40}Ca(p,^{3}He)^{38}K reaction .... See Entry 117521

Monopolar approximation to the P-H spectra of heavy calcium isotopes .... See Entry 117522

Proton correlations and the missing M1 strength in ^{48}Ca: a two-state model .... See Entry 117540

The estimation of β-delayed two-neutron emission probability in the $A \geq 50$ region .... See Entry 117553

Investigation of the ^{48}Ti(n,γ)^{49}Ti reaction .... See Entry 117569

The even-odd effect of the pre-equilibrium emission in ^{59}Co, ^{60}Ni, ^{63}Cu, ^{64}Zn (α,p) reactions .... See Entry 117578

Spin-orbit potentials for elastic scattering of polarized ^{6}Li ions from ^{12}C and ^{58}Ni .... See Entry 117584

27.50 $59 \leq A \leq 89$

In-beam gamma spectroscopic investigation of ^{73}Se .... See Entry 117508

The estimation of β-delayed two-neutron emission probability in the $A \geq 50$ region .... See Entry 117553

Measurement of the total neutron cross-section of selenium at neutron energies below 2 eV .... See Entry 117566

The determination of forward and backward average projectional recoil ranges in the ^{65}Cu(n,2n)^{64}Cu and ^{27}Al(n,α)^{24}Na reactions induced by D-T neutrons .... See Entry 117568

The even-odd effect of the pre-equilibrium emission in ^{59}Co, ^{60}Ni, ^{63}Cu, ^{64}Zn (α,p) reactions .... See Entry 117578

Band structure in ^{81}Sr .... See Entry 117579

A study of the (^{6}Li,^{7}Be) reaction in the mass-90 region at 60 MeV .... See Entry 117582

27.60 $90 \leq A \leq 149$

Further experimental test of nucleon charge conservation through the reaction ^{13}Cd$\rightarrow^{113m}$In+neutrals .... See Entry 117460

Atomic masses of rare earth isotopes ^{145}Pm and ^{151}Gd, derived from decay measurements of ^{145}Sm and ^{151}Gs .... See Entry 117520

Low-lying states of the ^{102}Rh nucleus .... See Entry 117524

Excited states in ^{128}Ba .... See Entry 117525

Decay of ^{109g}Pd to the levels of ^{109}Ag .... See Entry 117541

Half life and KX-ray-emission probability of ^{93}Nb^{m} .... See Entry 117544

Measurement of the beta-ray spectra of ^{90}Sr-^{90}Y .... See Entry 117549

Measurements and evaluation of decay data of fission products .... See Entry 117550

New isomers and their decay in odd-odd neutron-deficient cesium isotopes .... See Entry 117552

The estimation of β-delayed two-neutron emission probability in the $A \geq 50$ region .... See Entry 117553

Half-lives of the neutron-rich isotopes ^{100}Sr, ^{100}Y, ^{148}Ba and ^{148}La .... See Entry 117554

Beta-decay energy and nuclear mass of ^{100}Nb .... See Entry 117555

Experiments for the investigation of ground-state proton radioactivity .... See Entry 117558

Isotopic effects in the (*n,p*) reaction cross section on he;avy targets and the statistical preequilibrium model .... See Entry 117572

The even-odd effect of the pre-equilibrium emission in ^{59}Co, ^{60}Ni, ^{63}Cu, ^{64}Zn (α,p) reactions .... See Entry 117578

Low-lying levels in ^{125}Xe and ^{127}Xe .... See Entry 117580

A study of the (^{6}Li,^{7}Be) reaction in the mass-90 region at 60 MeV .... See Entry 117582

Pairing effects in quasi-elastic neutron transfer between tin isotopes .... See Entry 117589

27.70 $150 \leq A \leq 189$

Can a β-vibration band exist in ^{168}Er? .... See Entry 117509

Band-crossing studied by Cooper-pair exchange particles-plus-soft rotor model .... See Entry 117511

An extension of the rotating shell model and its application to ^{164}Er .... See Entry 117512

Residual interactions between aligned quasiparticles and pairing deformation changes in ^{165,166}Yb and ^{164}Er .... See Entry 117514

g Factors of the s band in ^{164}Er and ^{166}Yb .... See Entry 117515

Atomic masses of rare earth isotopes ^{145}Pm and ^{151}Gd, derived from decay measurements of ^{145}Sm and ^{151}Gs .... See Entry 117520

Multiple Coulomb excitation of ^{167}Er .... See Entry 117539

K/LM+ internal-conversion ratios for pure E2 transitions in the decays of ^{152}Eu and ^{192}Ir .... See Entry 117547

Standardization and decay data of ^{169}Yb .... See Entry 117548

Experiments for the investigation of ground-state proton radioactivity .... See Entry 117558

Isotopic effects in the (*n,p*) reaction cross section on he;avy targets and the statistical preequilibrium model .... See Entry 117572

27.80 $190 \leq A \leq 219$

Search for two-octupole-phonon states in ^{208}Pb .... See Entry 117510

g-boson renormalization effects in the interacting boson model for nondegenerate orbits .... See Entry 117516

K/LM+ internal-conversion ratios for pure E2 transitions in the decays of ^{152}Eu and ^{192}Ir .... See Entry 117547

Resonance parameters of the two low-energy iridium resonances .... See Entry 117563

A study of ^{206}Pb by inelastic scattering of 35 MeV protons .. See Entry 117570

Isotopic effects in the (*n,p*) reaction cross section on he;avy targets and the statistical preequilibrium model .... See Entry 117572

On the determination of the deuteron quadrupole moment by elastic scattering of polarised deuterons .... See Entry 117575

Linear momentum transfer investigated in the ^{20}Ne+^{197}Au and ^{209}Bi systems at 30 MeV/u .... See Entry 117585

27.90 $220 \leq A$

Gamma-ray-spectrometry measurements for actinide decay-scheme studies with particular reference to ^{231}Pa and ^{235}U .... See Entry 117538

The IAEA coordinated research programme on the measurement and evaluation of transactinium-isotope nuclear decay data .... See Entry 117556

Evaluation of non-neutron nuclear data for the ^{226}Ra decay-chain .... See Entry 117557

Curium-248 neutron data evaluation .... See Entry 117573

In-beam investigation of high-spin states in actinides with (α,xn) compound reactions .... See Entry 117581

Measurement of the prompt fission neutron multiplicity from the ^{245}Cm(n,f) and ^{242}Am(n,f) reactions .... See Entry 117592

28.00 NUCLEAR ENGINEERING AND NUCLEAR POWER STUDIES

(see also 86.10 Energy resources and their utilisation)

28.20 NEUTRON PHYSICS

(see also 25.40 Nucleon-induced reactions and scattering)

A simple theoretical investigation of the effect of a moderator present in the central region of a hollow fuel element .... See Entry 117604

28.41 FISSION REACTOR THEORY AND DESIGN

117594 COMETHE-IIIJ predictions of the fuel centerline temperatures in the IFA-431, IFA-432, and IFA-513 assemblies. L.Rayes, S.Lee, E.Y.Lim, E.T.Rumble, A.Woodis.
Report EPRI-NP-2992, Electr. Power Res. Inst., Palo Alto, CA, USA (May 1983), 78 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USa.
Results are presented of a comparison of the centerline fuel temperature predictions provided by the COMETHE-IIIJ computer code to measurements obtained from 18 BWR fuel rods with in-fuel thermocouples. The error characteristics of the COMETHE-IIIJ are summarized, and performance of the code in this test and for predicting fuel temperatures in reload licensing submittals is determined.

117595 VIPRE-01: A thermal-hydraulic analysis code for reactor cores. Vol.III: Programmer's manual. C.W.Stewart, A.S.Koontz, J.M.Cuta, S.D.Montgomery.
Report EPRI-NP-2511-CCM, Electr. Power Res. Inst., Palo Alto, CA, USA (May 1983), 190 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The authors present the programmer's manual for the VIPRE code, which was developed for nuclear power utility thermal-hydraulic analysis applications. The manual explains the structure of the code as well as the computer interfaces.

117596 Assessment, development, and application of LMFBR thermal-hydraulic analysis tools. W.P.Barthold, I.G.Barthold.
Report EPRI-NP-3167, Electr. Power Res. Inst., Palo Alto, CA, USA (July 1983), 150 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The authors discuss an evaluation of the whole-core LMFBR thermal-hydraulics codes COBRA-WC, COMMIX, CORE-3D, CORTRAN, and SUPER ENERGY-2. The design analyst's point of view was used to consider basic algorithms, code capabilities, physical models, user instructions, and general code features. An expanded version of CORTRAN, CORTRAN-C, was developed and applied to the analysis of split inlet plenum designs. Orificing strategies for these designs were investigated.

117597 Numerical simulation of steam separators used in nuclear steam generators and reactor systems. Vol.II: User's manual. M.J.Vander Vorst.
Report EPRI-NP-3063-CCM, Electr. Power Res. Inst., Palo Alto, CA, USA (June 1983), 102 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The author presents a user's manual for the SWIRL computer code, which simulates the fluid dynamics of a primary steam separator.

117598 Steam generator data base. W.Pearl, S.Sawochka.
Report EPRI-NP-3033, Electr. Power Res. Inst., Palo Alto, CA, USA (June 1983), 246 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The authors discuss the development of a data base that will provide comprehensive information on the effects of different PWR designs, materials, and operating conditions on the various corrosion phenomena involved. A discussion of the computer service and software selection used for the compilation of the data is given as well as an analysis of the questionnaires and their transmittal to the cooperating units. The appendix provides details on the computational tools for data storage access, and investigation.

117599 Modeling air-water tests with DUVAL. R.S.Dougall.
Report EPRI-NP-3163, Electr. Power Res. Inst., Palo Alto, CA, USA (July 1983), 50 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
Comparisons of the DUVAL computer code predictions to data obtained in two-dimensional two-phase flow air-water experiments are presented. The report documents conservation equations simulating these flows. The comparisons indicate that the DUVAL computer code can accurately simulate these air-water experiments without heat addition.

117600 Computer calculated potential pH diagrams to 300°C. Vol. III: User's guide for the computer program POT-pH-TEMP. C.M.Chen, K.Aral.
Report EPRI-NP-3137, Electr. Power Res. Inst., Palo Alto, CA, USA (June 1983), 98 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The authors present a user's guide for POT-pH-TEMP, a computer program to generate potential pH diagrams for many metal-water systems at various temperatures.

117601 Testing ENDF/B-V data for thermal reactors (Addendums 1, 2, 3). D.S.Craig.
Report AECL-7690, Atomic Energy Canada Ltd., Chalk River, Ont. (June 1983), 23 pp.
Four lattices have been added to those used to test the ENDF/B-V data for use with thermal reactors. One, LTRIIA, is a D_2O-moderated lattice of uranium fuel tubes arranged on a tight pitch. The other three, R1/100H, R2/100H and R3/100H, are H_2O-moderated lattices of UO_2. Two of these also have the fuel rods arranged on a tight pitch. The measurements made on LTRIIA are not consistent with each other and thus the lattice is not an ideal test lattice. However, calculations made at other laboratories using Monte Carlo and integral transport methods give different results. It was hoped that the calculations would help to resolve this difference. The choice of some of the input options and parameters for the OZMA code is discussed.

117602 Model investigations on core monitoring in large pebble-bed HTGRs using fast fission chambers in the top reflector. D.E.Carlson.
Report JUL-1853, Kernforschungsanlage, Julich, Germany (June 1983), 214 pp. In German.
The work presented is concerned with the detection of flux irregularities in large pebble-bed high-temperature reactors by means of measuring the fast (E_n>0.1 MeV) neutron flux distribution in the lower region of the top reflector. (35 refs.)

A simple theoretical investigation of the effect of a moderator present in the central region of a hollow fuel element .... See Entry 117604

Experimental investigation of heat exchange and hydraulic resistance during air flow in fuel element bundle cells .... See Entry 117614

Analysis of creep rupture data for five multiheat alloys by the minimum commitment method using double heat term centering technique ..See Entry 117615

Analysis of test lattice experiments in the light water high-conversion reactor PROTEUS .... See Entry 117617

Heat and mass transfer in a disperse nonequilibrium chemically reacting two-phase flow in a vertical channel .... See Entry 117635

Added mass computation for impellers in nuclear power pumps .... See Entry 117650

Method of predicting pressure profiles in horizontal 37-element clusters .... See Entry 117653

Measurements of fast neutron fluxes in HTR-OTTO-core configurations and comparison with theoretical calculations (Detection of flux perturbation) .... See Entry 117654

Bayesian estimation of core damage frequency incorporating historical data on precursor events .... See Entry 117673

A finite element quasi-Eulerian method for three-dimensional fluid-structure interactions .... See Entry 117678

Risk assessment in reactors .... See Entry 117681

Bending of an infinitely long rectangular wire in conditions of radiation-induced creep and swelling .... See Entry 119056

28.42 FISSION REACTOR MATERIALS

117603 Radiation protection aspects in permanent decommissioning of the N.S. 'Otto Hahn'. K.Henning (GKSS-Forschungszentrum Geesthacht GmbH, Geesthacht, Germany).
Atomwirtsch.-Atomtech. (Germany), vol.28, no.9, p.467-9 (Sept. 1983). In German.
After more than ten years of operation, the nuclear research vessel, N.S. 'Otto Hahn', was decommissioned in the period 1980 to 1982, i.e. dismantled and decontaminated to such an extent as to now contain only 'free areas' in the sense of the Radiation Protection Ordinance, which allows continued operation without a permit under the Atomic Energy Act of the vessel as a diesel operated commercial vessel. The case of the N.S. 'Otto Hahn' for the first time demonstrates for a nuclear plant, a complete nuclear waste management to the point of commercial re-use. (no refs.)

117604 A simple theoretical investigation of the effect of a moderator present in the central region of a hollow fuel element. A.Kakatsios, D.Leonidou (Lab. of Nuclear Engng., Nat. Tech. Univ., Athens, Greece).
Atomkernenerg. Kerntech. (Germany), vol.42, no.3, p.193-8 (1983).
In order to predict the thermal neutron flux increment in the fuel region of the cell, due to the transition from the situation without, to the one with a central moderator positioned in the central region of a hollow fuel element, a simple theoretical model is used in combination with several experimentally obtained magnitudes, taken in positions of the cell where access is possible. Though the theoretical model is based on the one group diffusion theory and on a number of simplifications, the proposed method gives results which are in a fair agreement with the experimentally obtained ones. (8 refs.)

117605 A probabilistic model for spent fuel management costs. P.Jauho.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.63-5 (1983).
A probabilistic analytic model for spent fuel management costs is developed to enable a calculation of statistical properties of costs, charges, funding, etc. The model is based on insurance mathematics. (2 refs.)

117606 Ceramization of nuclear wastes with clay. J.K.Miettinen, J.Lehto.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.132-6 (1983).
A new method to ceramize nuclear wastes with clay has been developed. Inorganic ion exchangers loaded with nuclear wastes were turned into final ceramic waste form by mixing them with a Finnish red clay in weight ratio 1:4 at maximum. The tiles moulded from the wet, bakeable mixture were ceramized at 1020-1060°C. The leach rates of Sr, Cs, and Co from the tiles determined by a dynamic ISO test were after six months of leaching $10^{-6}-10^{-7}$ g/cm^2×d, in decreasing order. Mechanically the tiles are very durable: flexural strengths were in the range of 20-45 meganewtons per square meter. (9 refs.)

117607 Assessment of flaw detection probability in the case of pressure vessel materials. H.Riikonen, J.Raussi, O.J.A.Tiainen.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.159-64 (1983).
Shaffer has presented a method for assessing flaw detection probability in pressure retaining components. In this case study the usefulness of Shaffer's method is examined using inspection data from a BWR-plant piping and mathematical fittings for size distributions of detected flaws. It was seen that the size distribution function has to fulfil many conditions to be useful for assessing the detection probability of flaws. The discovery of a proper Shaffer's ω function appears to be the key factor for the usefulness of the model. (4 refs.)

117608 Leachability of radionuclides from radioactive waste solidified products. S.Seki (JAERI, Tokyo, Japan).
J. At. Energy Soc. Jpn. (Japan), vol.25, no.7, p.571-6 (July 1983). In Japanese.
From leach tests of cement solidified products containing ^{137}Cs and ^{60}Co, it was concluded that the leachability of radionuclides from radioactive waste solidified products can be treated as the diffusion control. In obtaining the diffusion coefficient, the radioactive waste products are classified in two groups, permeable and nonpermeable, respectively, and the diffusion equations suitable for the respective groups are proposed. Accordingly, using the diffusion coefficients derived, the method of long-term estimations on the amounts leached is also proposed. (12 refs.)

117609 Estimation of multicomponent breakthrough curves in soil environment. N.Katoh, K.Nakamichi (Kogakuin Univ., Tokyo, Japan), H.Tasaka, T.Asano.
J. At. Energy Soc. Jpn. (Japan), vol.25, no.7, p.577-82 (July 1983). In Japanese.
Breakthrough curves were experimentally obtained for Co, Sr, Cs, Co-Sr and Co-Sr-Cs systems to examine effects of co-existence of nuclides on the absorptivity of a soil. Results showed that the breakthrough curves of same nuclide differ considerably from single to binary and ternary component systems. These phenomena cannot be explained by Henry type isotherm theory which is dominantly used in the field of radioactive waste management. In the present study, based on Freundlich type isotherm and Radke-Prausnitz theory, estimation of breakthrough curves of multicomponent systems was carried out and good agreement was obtained between estimated and experimental results. The method proposed here enables one to estimate multicomponent nuclide migration in the groundwater only using single component adsorption parameters. (14 refs.)

117610 Gamma dose-rates from the maximum-rated spent fuel bundle in KANUPP. K.F.Mirza (Karachi Nuclear Power Plant, Karachi, Pakistan).
Nucleus (Pakistan), vol.20, no.1, p.11-17 (Jan.-March 1983). [received: Oct. 1983]
Gamma dose-rates in air have been determined from a maximum-rated spent fuel bundle at different distances from the bundle and at different times after its discharge from the reactor core. At different intervals the dominant contributions to radiation dose are caused by different sets of radionuclides e.g. Cs-134 contributes only 5.4% of the total dose at 27.8 hrs after discharge but its contribution increases to 85.2% after 11.6 months when the shorter-lived activities have decayed. (no refs.)

117611 Nuclear fuel conversion characteristics in a nuclear power station in a fuel cycle with two compositions of cycling fuel. G.B.Usynin, V.A.Chirkov, S.V.Zbrueva.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.10-14 (1983). In Russian.
Fast reactor operation with two compositions of consumed fuel is considered. Calculation results of a BN-1600-type reactor for different consumed plutonium compositions in small and large enrichment zones are reported. The presence of ^{240}Pu in the fuel is shown to result in the fuel self-compensation with the degree of self-compensation in the large enrichment zone being, on the average, less than that in the small enrichment zone. The method of calculating physical characteristics according to fuel balance is formulated, an equation for estimating the rate of the system growth is given. (2 refs.)

117612 Theoretical investigation of the operation of cermet fuel elements in a BRIG-300 fast reactor. I.S.Kulikov, V.B.Nesterenko, B.E.Tverkovkin.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.14-18 (1983). In Russian.
Presents the theoretical results on the operation of cermet fuel elements in a fast gas-cooled BRIG-300-type reactor. The investigations have been conducted at the Nuclear Power Engineering Institute of the Byelorussian Academy of Sciences. (9 refs.)

117613 Chromatographic determination of gas-like impurities in a dissociating coolant. V.V.Leonova, V.V.Gren'.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.33-5 (1983). In Russian.
The chromatography technique for determining gaseous impurities in nitrogen tetroxide is described. The gas-chromatographic system to determine nitrogen, nitrogen oxide, nitrous oxide and oxygen in the 0.03 g coolant sample with the analysis time of 12 min and method sensitivity of 10^{-3}% is presented. The parameters of seperation of the determined components are given. (3 refs.)

117614 Experimental investigation of heat exchange and hydraulic resistance during air flow in fuel element bundle cells. O.S.Vasilevich, L.I.Kolykhan, A.V.Sheinina.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.72-6 (1983). In Russian.
The enhancement of heat transfer in air flowing in the cells of fuel element bundles with S/d=1.08, 1.12, 1.13 and roughness in form of rectangular lateral ribs with height h=0.02, 0.03 mm and pitch t=0.75 mm has been investigated. The empirical expressions have been derived for evaluating drag

and heat transfer coefficients in the fuel elements bundles with artificial roughness in the test range of geometry and conditions parameters. (13 refs.)

117615 Analysis of creep rupture data for five multiheat alloys by the minimum commitment method using double heat term centering technique. S.S.Manson, U.Muralidharan.
Report EPRI-CS-3171, Electr. Power Res. Inst., Palo Alto, CA, USA (July 1983), 74 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA, USA.
The authors develop the heat term concept of adapting the minimum commitment method for characterizing individual heats of multiheat materials data. Programs permitting the use of desk top microcomputers are included. A preliminary study is presented to show that it is possible that the long-term characteristics of a particular construction material heat can be estimated to a high degree of accuracy using short-time data from that heat together with longer time data from other heats of the same material.

117616 LWR core materials performance program: Progress in 1981-1982.
Report EPRI-NP-3150-SR, Electr. Power Res. Inst., Palo Alto, CA, USA (July 1983), 144 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
This report describes the progress made in 1981 and 1982 by the EPRI Light Water Reactor Core Materials Performance Program. The active projects under this program range in scope from test reactor experiments of advanced fuel types to large-scale testing of prototypic fuel assemblies. During 1981 and 1982, several projects produced significant results in a number of areas. The primary emphasis continues to be on fuel reliability with demonstrations of extended fuel burnup capability receiving significant support.

117617 Analysis of test lattice experiments in the light water high-conversion reactor PROTEUS. E.Hettergott, R.Chawla, K.Gmur.
Report EPRI-NP-3190, Electr. Power Res. Inst., Palo Alto, CA, USA (July 1983), 62 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The authors describe the preliminary analysis of a series of tight-pitch lattice experiments conducted at the PROTEUS zero-power reactor facility in Switzerland. Data is presented on a PuO_2/UO_2-fueled test lattice with a fuel-to-moderator ratio of approximately 2.0 Measurements include the capture rate in ^{238}U and fission rates in ^{235}U, ^{238}U, ^{239}Pu, and ^{241}Pu.

117618 Evaluation of BWR resin intrusions on stress corrosion cracking of reactor structural materials. R.J.Kurtz, D.W.Shannon, B.Francis, F.M.Kustas, P.L.Koehmstedt.
Report EPRI-NP-3145, Electr. Power Res. Inst., Palo Alto, CA, USA (June 1983), 70 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The authors discuss a study of the stress corrosion and corrosion fatigue behavior of type-304 stainless steel when exposed to off-normal BWR water chemistry conditions. Normal high-purity BWR water and an impure BWR water that simulated ion exchange resin releases from the demineralizer system and their chemical conditions are evaluated.

117619 Optimization of metallurgical variables to improve corrosion resistance of Inconel alloy 600. G.P.Airey.
Report EPRI-NP-3051, Electr. Power Res. Inst., Palo Alto, CA, USA (July 1983), 304 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
Several aspects of the corrosion performance and characterization of thermally treated and mill-annealed alloy 600 tubing are studied. It is confirmed that special thermal treatment improves SCC of alloy 600. A model for improved SCC resistance is developed. The carbide dissolution and precipitation kinetics are confirmed, and the long-term low-temperature microstructural changes in alloy 600 are evaluated. Finally the author establishes suitable stress relief annealing parameters.

117620 Effect of localized waste-container failure on radionuclide transport from an underground nuclear waste vault. S.C.H.Cheung, T.Chan.
Report AECL-7796, Atomic Energy Canada Ltd., Chalk River, Ont. (July 1983), 13 pp.
In the geological disposal of nuclear fuel waste, one option is to emplace the waste container in a borehole drilled into the floor of the underground vault. In the borehole, the waste container is surrounded by a compacted soil material known as the buffer. A finite-element simulation has been performed to study the effect of localized partial failure of the waste container on the steady-state radionuclide transport by diffusion from the container through the buffer to the surrounding rock and/or backfill. In this study, the radionuclide concentration at the buffer-backfill interface is assumed to be zero. Two cases are considered at the interface between the buffer and the rock. In case 1, a no-flux boundary condition is used to simulate intact rock. In case 2, a constant radionuclide concentration condition is used to simulate fractured rock with groundwater flow. (8 refs.)

117621 Diffusional mass transport phenomena in the buffer material and damaged zone of a borehole wall in an underground nuclear waste vault. S.Page, S.C.H.Cheung.
Report AECL-7788, Atomic Energy Canada Ltd., Chalk River, Ont. (June 1983), 20 pp.
The effects of the geometry of the borehole and the characteristics of the damaged borehole rock wall on the movement of radionuclides from an underground nuclear waste vault have been studied. The results show that radionuclide transport will occur mainly through the buffer into the damaged zone of the borehole wall. As the degree of fracturing of the damaged zone increases, the total radionuclide flux will increase up to a limit which can be approximated by a one-dimensional radial diffusion model. For large degrees of fracturing of the damaged zone, an increase in the radial buffer material thickness will decrease the total flux, whereas, for small degrees of fracturing, an increase in the radial buffer thickness may slightly increase the total flux. Increasing the vertical buffer thickness will significantly decrease the total flux when the degree of fracturing of the damaged zone is small. An increase in the vertical extent of the damaged zone will cause an increase in total flux. (7 refs.)

117622 High-level waste glass field burial tests at CRNL: The effect of geochemical kinetics on the release and migration of fission products in a sandy aquifer. T.W.Melnyk, F.B.Walton, H.L.Johnson.
Report AECL-6836, Atomic Energy Canada Ltd., Chalk River, Ont. (June 1983), 53 pp.
In 1960 June, 25 nepheline syenite-based glass hemispheres containing the fission products ^{137}Cs, ^{90}Sr, ^{144}Ce and ^{106}Ru were buried below the water table in fluvial sand at the Chalk River Nuclear Laboratories of Atomic Energy of Canada Limited. Soil and groundwater concentrations of ^{90}Sr and ^{137}Cs have been determined since then and the data have been interpreted using kinetically limited migration models to deduce the leaching history of the glass for these burial conditions. The leaching history derived from the field data is compared to laboratory leaching of samples from a glass hemisphere retrieved in 1978, and also to pre-burial laboratory leaching of identical hemispheres. The time dependence of the leach rates observed for the buried specimens suggests that leaching is being inhibited by the formation of a protective surface layer, although no direct observation of this layer has been made. The effect of the kinetic limitations of the fission-product/fluvial-sand interactions is discussed with respect to the migration of ^{90}Sr and ^{137}Cs over a 20-a time scale. (28 refs.)

117623 Canadian nuclear fuel waste management program. T.E.Rummery, E.L.J.Rosinger.
Report AECL-7787, Atomic Energy Canada Ltd., Chalk River, Ont. (May 1983), 18 pp.
The Canadian Nuclear Fuel Waste Management Program is now well established. This report outlines the generic research and technological development underway in this program to assess the concept of immobilization and subsequent disposal of nuclear fuel waste deep in a stable plutonic rock in the Canadian Shield. The program participants, funding, schedule and associated external review processes are briefly outlined. The major scientific and engineering components of the program, namely, immobilization studies, geoscience research and environmental and safety assessment, are described in more detail. (58 refs.)

117624 Characterization of low and medium level radioactive waste forms. R.A.J.Sambell.
Report EUR 8663 EN, Comm. European Communities, Luxembourg (1983), vii+111 pp. Contract 235-81-13 WAS-DK, 240-81-13 WAS-D, 242-81-13 WAS-UK, 243-81-13 WAS-UK, 244-81-15 WAS-F, 245-81-15 WAS-B.
The work reported was carried out during the first year of the Commission of the European Community's programme on the characterization of low and medium level waste forms. Ten reference waste forms plus others of special national interest have been identified covering PWR, BWR, GCR and reprocessing wastes. The immobilising media include the three main matrices: cement, polymers and bitumen and a glass. Characterization is viewed as one input to quality assurance of the waste form and covers: waste-matrix compatibility, radiation effects, leaching, microbiological attack, shrinkage and swelling, ageing processes and thermal effects. The aim is a balanced programme of comparative data, predictive modelling and an understanding of basic mechanisms. (34 refs.)

117625 Ballooning of thin-walled tubes with an azimuthal temperature gradient. R.S.W.Shewfelt.
Report AECL-7799, Atomic Energy Canada Ltd., Chalk River, Ont. (Sept. 1983), 16 pp.
The analysis of the ballooning of thin-walled tubes with azimuthal temperature gradients is frequently simplified by assuming the cross section remains circular. To estimate the errors caused by this assumption, a two-dimensional model was developed to estimate the deviations from a circular cross section caused by an azimuthal temperature gradient. The deviations were found to be small for the azimuthal temperature distributions considered and, consequently, predictions made by assuming the cross section remains circular are adequate. (2 refs.)

117626 Parameter-sensitivity analysis of near-field radionuclide transport in buffer material and rock for an underground nuclear fuel waste vault. S.C.H.Cheung, T.Chan.
Report AECL-7801, Atomic Energy Canada Ltd., Chalk River, Ont. (Aug. 1983), 31 pp.
An analytical model has been developed for radionuclide transport in the vicinity of a nuclear fuel waste container emplaced in a borehole. The model considers diffusion in the buffer surrounding the waste container, and both diffusion and groundwater convection in the rock around the borehole. A parameter-sensitivity analysis has been done to study the effects on radionuclide flux of (a) Darcian velocity of groundwater in the rock, (b) effective porosity of the buffer, (c) effective porosity of the rock, (d) radial buffer thickness, and (e) radius and length of the container. (14 refs.)

Measurement of the total neutron cross-section of selenium at neutron energies below 2 eV .... See Entry 117566

COMETHE-IIIJ predictions of the fuel centerline temperatures in the IFA-431, IFA-432, and IFA-513 assemblies .... See Entry 117594

Heat and mass transfer in a disperse nonequilibrium chemically reacting two-phase flow in a vertical channel .... See Entry 117635

Crevice corrosion of lattice support alloys in secondary environments of nuclear steam generators .... See Entry 117647

Method of predicting pressure profiles in horizontal 37-element clusters .... See Entry 117653

Application of integrated detection systems for in-core instrumentation of nuclear power plants .... See Entry 117658

Application of artificial intelligence to the detection and diagnosis of core faults in fast reactors .... See Entry 117664

LOCA hydroloads calculations with multidimensional nonlinear fluid/structure interaction. Vol.IV. Fluid/structure interaction application studies .... See Entry 117682

Dekontamination von Komponenten stillgelegter Kernkraftwerke fur die freie Beseitigung (Decontamination of components of closed-down nuclear power stations for open air disposal) .... See Entry 117706

Neutron scattering model for benzene .... See Entry 118000

Bending of an infinitely long rectangular wire in conditions of radiation-induced creep and swelling .... See Entry 119056

Experimental determination of ultrasonic velocity in liquid N_2O_4 at temperatures of 282-417K and up to 80 MPa pressure .... See Entry 119108

On the correspondences between experimental sound velocities in liquid N_2O_4 with density and specific heat .... See Entry 119109

Mechanical properties of Cr-Ni steels and alloys after testing in N_2O_4 .... See Entry 120388

Study of the effect of circumferential temperature variations on fuel-sheath strain in an inert atmosphere .... See Entry 120389

Fractographic observations of cleavage initiation in the ductile-brittle transition region of a reactor-pressure-vessel steel .... See Entry 120422

Dumping of radioactive wastes at sea .... See Entry 120775

Tobermorites: a new family of cation exchangers .... See Entry 121236

28.42H Fuel preparation and reprocessing

(inc. isotope separation and enrichment)

117627 Advanced isotope separation. Nuclear chemistry for the 21st century. C.B.Stevens (Fusion Energy Found., New York, NY, USA).
Fusion (USA), vol.5, no.2, p.36-41 (Dec. 1981). [received: Sept. 1983]
Isotope separation has been the key to the development of the most advanced frontiers of 20th-century science and technology, in particular nuclear fission and fusion. If declassified and fully developed with the aid of plasma bombardment, it will cheapen energy production and revolutionize materials science. (no refs.)

117628 Substoichiometric extraction of thorium with PMBP. Yu Yufu, Tang Jingjuan, Ye Minglu (Dept. of Nuclear Sci., Fudan Univ., Shanghai, China).
He Huaxue Yu Fangshe Huaxue (China), vol.4, no.4, p.228-33 (Nov. 1982). In Chinese. [received: Sept. 1983]
In studying the substoichiometric extraction of thorium with 1-phenyl-3-methyl-4-benzoyl-pyrazolone-5 (PMBP), it was found that thorium can be extracted substoichiometrically by $5.0\times10^{-4}M$ PMBP-xylene solution in the range of pH 4.5-5.5. Thorium in synthetic mixture solution and ore samples was determined by substoichiometric isotope dilution method and the preliminary results were presented. (13 refs.)

117629 Monitoring plutonium enrichment in mixed-oxide fuel pellets inside sealed nuclear fuel pins by neutron radiography. J.K.Ghosh, J.P.Panakkal, P.R.Roy (Radiometall. Div., Bhaba Atomic Res. Centre, Bombay, India).
NDT Int. (GB), vol.16, no.5, p.275-6 (Oct. 1983).
The possibility of using neutron radiography for monitoring plutonium enrichment in mixed-oxide fuel pellets inside welded fuel pins has been explored. Neutron radiographs of pellets containing 0-6% weight PuO_2 have been analysed by microdensitometry. The optical density of the radiographs has been correlated to the compositional variations in the fuel pellets studied. Analysis of the experimental results in presented. (6 refs.)

117630 Third-order aberration-free ion-optical system for an electromagnetic isotope separator. I.Chavet.
Report IA-1379, Israel Atomic Energy Comm., Tel Aviv (Dec. 1982), 9 pp.
The essential qualities required of a production isotope separator are high output and high enrichment factor. For this purpose, the imaging system should have as little geometric aberration as possible. In the proposed system, consisting of a homogeneous sector-type analyzing magnet, the beam is crossed in the axial direction at the entrance boundary of the magnetic field and the incidence to this boundary is normal. It is shown that for this case all radial aberrations to the 'practical' third order can be eliminated provided four optical conditions are satisfied: two related to heterogeneous aberrations terms in addition to the two conditions related to the second and third order homogeneous aperture aberration terms. The resulting equations take into account the magnetic fringe-field effects to the third order. (5 refs.)

A probabilistic model for spent fuel management costs ....See Entry 117605

Experimental investigation of heat exchange and hydraulic resistance during air flow in fuel element bundle cells ....See Entry 117614

28.43 FISSION REACTOR OPERATION

117631 Performance of platinum self-powered neutron detectors in the simulated conditions of a pressurized water reactor. A.A.Kendoush, S.M.Al-Jobori, H.H.Ahmed, H.Z.Mohamed (Iraqi Atomic Energy Comm., Tuwaitha-Baghdad, Iraq).
Atomkernenerg. Kerntech. (Germany), vol.42, no.3, p.174-6 (1983).
An experiment was designed to investigate the performance of platinum emitter SPNDs. The SPNDs were irradiated in the periphery of Osiris reactor for 3 cycles. The range of operating temperature in the experiment was (250-400)°C. Measurements were obtained for the sensitivity, linearity, response, stability and temperature effects of Pt SPNDs. It was found that the operation of the 0.5 mm emitter diameter was more reliable than the 1.0 mm emitter diameter during the increase in the operating temperature. (9 refs.)

117632 Cooldown performance capability of atmospheric steam dump system. J.D.Harris (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Nucl. Saf. (USA), vol.24, no.4, p.471-84 (July-Aug. 1983).
The steam generator atmospheric steam dump (ASD) system is evaluated to assess its thermal-hydraulic ability to cool down the reactor coolant system and steam generators following a design basis event (DBE) in which the main steam isolation valves close. A number of pressurized-water reactors are examined to evaluate ASD system performance within the constraints of the available licensing feedwater supply. Calculations using Final Safety Analysis Report data show that, although the ASD system is vital for safety following a DBE, design inadequacies exist which indicate unresolved safety and licensing issues at a number of operating plants. (38 refs.)

117633 Prevention and mitigation of steam generator water hammer events in PWRs. J.T.Han, N.Anderson.
Nucl. Saf. (USA), vol.24, no.4, p.533-7 (July-Aug. 1983).
Water hammer in nuclear power plants is an unresolved safety issue under study by the Nuclear Regulatory Commission (NRC). The authors summarize (1) the causes of steam generator water hammer (SGWH) events in pressurized-water reactors (PWRs), (2) various methods used to prevent or mitigate SGWH events, and (3) modifications that have been made at each operating PWR. (14 refs.)

117634 REWET-II facility for experiments on the loss-of-coolant accident in nuclear reactors. H.Kalli, T.Kervinen, A.Hamalainen.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.66-71 (1983).
REWET-II is an experimental facility for studies of the reflood phase during a loss-of-coolant accident. The emphasis is on simulation of the pressurized water reactors in use in Finland. The facility, its scaling principles, main measurements and fuel rod simulators are described. The simulator rods are compared with the real fuel rods by computer. The difference in the behavior of the rods is explained and discussed. (5 refs.)

117635 Heat and mass transfer in a disperse nonequilibrium chemically reacting two-phase flow in a vertical channel. V.A.Nemtsev.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.46-50 (1983). In Russian.
A one-dimensional mathematical model for heat and mass transfer of a dispersed two-phase nonequilibrium chemically reacting N_2O_4 flow in a vertical channel has been elaborated. The influence of chemical reaction kinetics on the basic characteristics of a steam generating channel in the second-kind burnout region has been investigated. (4 refs.)

117636 A review of condensate demineralizer regeneration procedures. D.P.Siegwarth, K.A.Friedman, D.A.McNea.
Report EPRI-NP-2975, Electr. Power Res. Inst., Palo Alto, CA, USA (April 1983), 68 pp.
Available from Research Report Centre, Box 50490, Palo Alto, CA 94303, USA.
Performance of deep-bed condensate demineralizers for sodium chloride removal from condensate was evaluated in the laboratory for several different regeneration procedures. Sodium and chloride removal efficiency data, sulfate throw, and resin analysis results are presented. Condensate polisher design and operating guidelines are provided that emphasize good resin separation—identified as the factor responsible for positive laboratory results—in order to achieve water quality meeting PWR Secondary Water Chemistry Guidelines.

117637 Chemical cleaning process evaluation - Westinghouse steam generators. W.F.Cleary, G.B.Gockley.
Report EPRI-NP-2987, Electr. Power Res. Inst., Palo Alto, CA, USA (April 1983), 140 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The authors present an assessment by Westinghouse Electric Corporation of the results of laboratory work and demonstration testing for developing a generic chemical cleaning process for the secondary side of PWR steam generators. In addition, recommendations are provided for methods of transferring the generic process to a Westinghouse plant-specific application, and the report identifies chemical cleaning corrosion guidelines for the construction materials in Westinghouse steam generators.

117638 Evaluation of secondary-system layup and cleanup practices and processes. W.F.Cleary.
Report EPRI-NP-2977, Electr. Power Res. Inst., Palo Alto, CA, USA (April 1983), 120 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The study of PWR secondary-system layup and cleanup practices, undertaken to evaluate current and proposed methods of corrosion-product control associated with extended plant outages, is summarized. The study includes a field survey of 14 representative PWR plants, an extensive literature search, and an evaluation of corrosion-product transport data. Recommendations for layup and cleanup system processes are derived from these practices and related information, and the layup and cleanup system process design information is provided.

117639 Design and testing of a laboratory gamma-ray densitometer for two-phase flow. M.Herschthal, M.Kawaji, S.Banerjee.
Report EPRI-NP-2819, Electr. Power Res. Inst., Palo Alto, CA, USA (April 1983), 70 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
A scanning narrow-beam gamma-ray densitometer, developed for measurements of void profiles during reflood, is described. The design principles, details of construction, and experiments to calibrate the densitometer are presented.

117640 State-of-the-art evaluation of condensate polisher performance. S.J.Elmiger, S.J.Potterton.
Report EPRI-NP-2978, Electr. Power Res. Inst., Palo Alto, CA, USA (April 1983), 386 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The authors document the methodology used for the results of a detailed survey conducted at 142 operating power plants to determine the capabilities and limitations of current generation condensate polisher systems. Results indicate that condensate polishers can be (and are being) designed and operated to produce the high-quality feedwater required in current generation power plants.

117641 Two-phase flow characteristics during controlled oscillation reflooding of a hot vertical tube. Y.S.Ng, S.Banerjee.
Report EPRI-NP-2821, Electr. Power Res. Inst., Palo Alto, CA, USA (May 1983), 98 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The authors present the results of experiments performed to determine the transient void fraction in a heated vertical tube under oscillatory inlet flow conditions. Experimental results are discussed for oscillations of various amplitudes and periods, which were superimposed on a constant feed rate. In addition, measurements made of temperatures, void fraction, and mass carry-over are given.

117642 Ultrasonic enhancement of chemical cleaning of steam generators. T.Scharton.
Report EPRI-NP-2997, Electr. Power Res. Inst., Palo Alto, CA, USA (April 1983), 290 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303. USA.
The results of an investigation into the use of ultrasound to enhance the chemical cleaning of steam generator tube and support crevices are presented. Focus is placed on the coupling of the transducers to the wrapper plate, the transmission of sound through the tube bundle, and the determination of cavitation threshold levels. The testing demonstrated that ultrasonics is an effective means of enhancing the crevice cleaning if sound levels sufficient to cause cavitation can be transmitted to the crevices.

117643 Analysis of sludge from Indian Point 3. C.L.Nealy, M.M.Klenck.
Report EPRI-NP-3027, Electr. Power Res. Inst., Palo Alto, CA, USA (June 1983), 62 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
Detailed chemical analyses of samples of Indian Point 3 PWR steam generator sludge are presented. The entire chemical analyses are described, primary sludge components as well as observed elements at levels of 1.2% and less than 1% are identified, and the separation and subsequent analysis of an anion and a cation resin fraction are discussed in detail.

117644 In situ calibration of nuclear plant platinum resistance thermometers using Johnson noise methods. T.V.Blalock, R.L.Shepard.
Report EPRI-NP-3113, Electr. Power Res. Inst., Palo Alto, CA, USA (June 1983), 142 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
Three methods are presented for in situ calibration of reactor plant platinum resistance thermometers using Johnson noise measurements were tested in the laboratory and in operating Diablo Canyon and Sequoyah nuclear plant reactors. Results of tests designed (1) to investigate these in situ calibration

methods, (2) to determine possible error uncertainties and to quantify their effects, and (3) to identify future research areas in Johnson noise thermometry are reviewed. Calibration test results are detailed.

117645 Pressurized fluidized-bed combustion cycle screening study. J.C.Dille, P.A.Berman.
Report EPRI-CS-3151, Electr. Power Res. Inst., Palo Alto, CA, USA (July 1983), 138 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
Results are provided of a study, which focused almost exclusively on thermodynamic performance, that was conducted to evaluate a large number of different pressurized fluidized-bed combustion plant configurations in order to identify performance trends. The best candidates for mid-term development and for near-term utility application are reviewed, and a parametric sensitivity study showing the effect of key parameters on the performance of the most promising cycles is included.

117646 High-reliability condenser design study. Y.G.Mussalli, R.J.Bell, A.M.Impagliazzo.
Report EPRI-CS-3200, Electr. Power Res. Inst., Palo Alto, CA, USA (July 1983), 250 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The authors present a review of US and European condenser designs and practices in order to recommend improvements and further research needs. Condenser integrity, deaeration, and thermal performance are discussed as well as designs to improve performance of condenser-associated systems, including macro- and micro-fouling control technologies and improved cooling-water pump designs. Several areas for research are identified.

117647 Crevice corrosion of lattice support alloys in secondary environments of nuclear steam generators. M.C.H.McKubre, S.C.Leach, L.E.Eiselstein.
Report EPRI-NP-3045, Electr. Power Res. Inst., Palo Alto, CA, USA (July 1983), 140 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
This report summarizes a study to determine the extent to which galvanic coupling effects are significant for initiating and sustaining corrosion in crevices. Particular emphasis is placed on determining how crevice and bulk water chemistry affect the corrosion rate. Experiments in a single-pass flow tube containing 14 specimens in different crevice geometries are described. Corrosion of support alloys is related to alloy content and pH.

117648 PWR model steam generator corrosion studies. R.M.Rentler, J.W.KLisiewicz, K.E.Marugg, J.K.Hayes, E.E.Grondahl.
Report EPRI-NP-3138, Electr. Power Res. Inst., Palo Alto, CA, USA (June 1983), 220 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
Results of a series of high-temperature heat transfer corrosion tests, designed to examine the effects of water chemistry variations on steam generator material corrosion, are reported. Details are provided of the four-year testing effort, which was carried out in four-tube low-heat-flux pot boilers and in multitube model steam boilers and which focused on the role of specific impurities relative to the corrosion of carbon steel support structures as well as a laboratory production of tube denting.

117649 Steam generator chemical cleaning: Demonstration test in a model boiler. G.C.Fink, M.H.Helyer, G.L.Key, D.B.Scott.
Report EPRI-NP-2990, Electr. Power Res. Inst., Palo Alto, CA, USA (June 1983), 312 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
Results of the final demonstration testing of the Steam Generator Owners Group generic chemical cleaning process, developed to chemically remove steam generator corrosion-product accumulants, are documented. Evaluation of the effectiveness of the process for (1) high-copper-content sludge removal and (2) cleaning of dented tube support crevices and the quantification of the corrosivity of the process to the generator base metals are reported.

117650 Added mass computation for impellers in nuclear power pumps. W.K.Liu, D.Lam, T.Belytschko.
Report EPRI-NP-3202, Electr. Power Res. Inst., Palo Alto, CA, USA (July 1983), 82 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The authors present results of a study conducted to examine the fluid forces in the shaft and impeller regions of a pump and focuses on a method developed for calculating the effect of the hydrodynamic mass on the impeller stage of the rotor. Details are provided on the method, and a comparison of this method, which includes an accurate, three-dimensional representation of the impeller shape and the pump geometry as well as the effects of the velocity of the fluid, is made with previous approaches and current practices.

117651 Evaluation and improvement of PWR secondary-system oxygen control measures. A.D.MacArthur.
Report EPRI-NP-3020, Electr. Power Res. Inst., Palo Alto, CA, USA (July 1983), 502 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA, USA.
The author studies the design and operation of balance-of-plant systems and components to minimize oxygen-induced corrosion in the secondary systems of PWRs are presented. Recommendations for equipment and design options, as well as associated costs for making plant modifications that would correct the air inleakage in most plants are suggested. Details are provided on an evaluation of the use of hydrazine to scavenge oxygen in secondary systems and on recommendations for operating and maintenance practices.

117652 Condensate polishing at Surry Nuclear Power Station. D.A.McNea, D.P.Siegwarth, K.A.Friedman, S.G.Sawochka.
Report EPRI-NP-3037, Electr. Power Res. Inst., Palo Alto, CA, USA (June 1983), 114 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
Results are presented of a detailed study conducted at the Surry Nuclear Power Station to evaluate the capability of the deep-bed condensate polisher systems to achieve water quality to meet the PWR Secondary Water Chemistry Guidelines. Polisher operation during normal operation and during periods of simulated condenser cooling-water inleakage is analyzed. Additionally, the results of less extensive site studies at the Ginna and Trojan nuclear stations are documented.

117653 Method of predicting pressure profiles in horizontal 37-element clusters. C.W.Snoek, S.Y.Ahmad.
Report AECL-8065, Atomic Energy Canada Ltd., Chalk River, Ont. (May 1983), 22 pp.
A new two-phase friction multiplier correlation has been developed to predict the pressure profile in two-phase flow with heat addition. The main difference from other pressure drop prediction routines is that in addition to the effect of quality, the effects of system pressure, heat and mass flux on the two-phase multiplier are included. The inception of two-phase flow is defined to occur at the onset of significant void in the subcooled boiling regime instead of the boundary between negative and positive thermodynamic equilibrium quality. Pressure drop data from an experiment with a fully segmented 6-metre long, 37-element fuel string were used to optimize the constants and exponents of this correlation for the friction multiplier. The authors present the derivation of the equations in a systematic manner. The effects of the system parameters on the prediction error are discussed in detail. (14 refs.)

117654 Measurements of fast neutron fluxes in HTR-OTTO-core configurations and comparison with theoretical calculations (Detection of flux perturbation). M.Khamis.
Report JUL-1852, Kernforschungsanlage, Julich, Germany (June 1983), ii+145 pp. In German.
Measurements of the absolute fast neutron fluxes and reactor power have been carried out on the critical facility KAHTER in the Institute for Reactor Development at the Kernforschungsanlage Julich GmbH. The Once Through Then Out core loading schemes OTTO 0/5 and OTTO 5/5 for the pebble-bed HTGR were investigated. The measurement results with the threshold detectors Rh^{103} and In^{115} as well as with U^{235}-, Np^{237}- and Th^{232}-fission chambers have been compared to calculations with the program cycles GAMTEREX and MUPO-CITATION. A further task was to check for statistical effects of the pebble-bed loading on the consistency of the measured values. Experiments with fast fission chambers were also performed to investigate the detectability of various flux perturbations in the upper core region by means of a detector system in the top reflector. (64 refs.)

117655 A surveillance system for nuclear reactors based on sequential pattern recognition methods. E.Saedtler (Gesellschaft fur Reaktorsicherheit mbH, Garching, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.323-32 vol.3
Discusses a surveillance system for nuclear power reactors based on sequential pattern recognition and large scale identification techniques. Bayes' decision theory is introduced and a maximum-a-posteriori filter algorithm is used compared with a multilevel structuring of the model, to estimate the likelihood ratios for a M-ary hypothesis test. With these procedures a computer controlled vibration monitoring and instrumentation surveillance system for power plants shall be realized. An empirical model is developed and some results, achieved with real data, are presented. A multimicroprocessor architecture for the surveillance problem is briefly described. (4 refs.)

117656 A new tool for nuclear reactor diagnostics. J.Valko, L.Zeke (Central Res. Inst. for Phys., Hungarian Acad. of Sci., Budapest, Hungary).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.333-42 vol.3
Presents a description of the architecture of a very fast digital signal analyser system (DSAS) for stand alone or computer controlled data processing. The special measuring environment has profound implications on the design of the DSAS. Attention is directed primarily to the modular architecture requirements of DSAS in order to achieve high real-time speed and intelligent data handling. (5 refs.)

117657 Broader utilization of programmable automation equipment in French nuclear power plants: reflections on the choices made by Electricite de France and French designers. Y.Baudry, G.Varaldi (Electricite de France, Paris, France).
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.3-11 In French.
More than 1000 microprocessors and more than 10000 data memories in each of the twenty or so 1300 MW units in the French nuclear programme: that was the decision taken by Electricite de France (EDF) in conjunction with the designers in 1974, with the intention of introducing programmable automata on a wide scale in French nuclear power plants. Having used computers for linking sequences (themselves carried out with electromagnetic technology) for its latest natural-uranium gas-cooled graphite-moderated power plants, EDF decided to call a temporary halt, in the case of its 900 MW light-water range, to the use of digital techniques for the control and automation of power plants although it continued to employ such techniques widely in data processing. Thus, the widespread introduction of programmable automata led EDF and French designers to undertake a major development effort in order to meet the requirements—particularly safety and reliability requirements—for such automata to be incorporated into the nuclear field. The authors consider how this choice fits in with the logical evolution of the digitalization of French nuclear power plants and the problems it has caused for EDF and French industry. (6 refs.)

117658 Application of integrated detection systems for in-core instrumentation of nuclear power plants. J.Kott (Skoda Concern, Plzen, Czechoslovakia), V.Krett.
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.13-20
On the basis of results of research and development, the advantages and disadvantages of detection systems for in-core reactor instrumentation are evaluated. The technological feasibility and the application of such systems are discussed as well as their potential economic benefits. The authors present long-term research and development results for such systems which are intended to measure physical and thermotechnical core parameters in a fuel assembly. Experience gained with these systems is discussed, together with their evaluation in an operational nuclear power reactor. The systems make it possible to determine experimentally the basic safety characteristics by means of measuring the coolant flow, pressure and pressure pulsations, neutron flux, heat generation, and heat of coolant and fuel assembly surfaces, enabling an exact determination of the fuel assembly heat output. (5 refs.)

117659 Improving 900 MWe PWR control rooms. M.Bouat, R.Marcille (Electricite de France, Paris, France), J.L.Testud, D.Viard.
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.33-42 In French.
Analyses of the behaviour of operators during operating tests on PWR units and the lessons learned from the TMI-2 accident have demonstrated the need to improve the interface between operators and the facilities they control. To that end, and to complement its establishment of safety panels, Electricite de France (EDF) embarked upon a study on the 'Modification of Control Desks and Boards' in control rooms. This study, involving twenty-eight 900 MW(e) units, almost all of which are currently in service, began with an ergonomic analysis of control rooms. This analysis was based on interviews with simulator instructors and operators, a study of the operation of the unit, and a general review of previous studies. It resulted, in April 1981, in a critical report and a proposal to create a full-scale mock-up of a 900 MW(e) control room. The alterations to be made will make it necessary to revamp the control panels completely. The work and tests involved should match the duration of refuelling shut-downs. (no refs.)

117660 Control-room mock-up for the Philippsburg nuclear power plant, unit 2. M.Gamer (Badenwerk AG, Karlsruhe, Germany), E.Jager, G.Wohrle.
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.43-56
The authors describe the major aspects of the construction of a full-scale control-room mock-up for Unit 2 (1300 MW PWR) of the Philippsburg nuclear power plant. The multitude of monitoring and control systems, co-operative control-room modelling by the planning staff as well as the operating staff, including the feedback of experience gained during operation, and the practice-oriented application of human factors engineering, especially the optimization of the man/machine interface, are emphasized. The most important improvements in the application of human factors engineering in process instrumentation and control are listed. The consequent structuring of mimic diagrams and instruments both by colour and shape is a fundamental step. A computerized operator support system has been installed with the aim of improving the man/machine interface. (8 refs.)

117661 Exchange of plant computers at Ringhals 1: system philosophy and orgnaizational requirements. B.-M.Jacobsson (Swedish State Power Board, Vallingby, Sweden).
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.97-106
The author describes work in connection with the exchange of the plant computers at the Ringhals nuclear power plant. The new systems will contain the functions of the old system as well as some new functions. They will have to provide information for the 'Safety Panel' and the 'Technical Support Centre'. The author emphasizes the requirements to be met by the buying organization in order to be able to specify, install, verify, use and maintain such a system. (no refs.)

117662 Decision-making aid for operational crews: status of the EPRI DASS project. A.J.Spurgin, D.G.Cain, A.B.Long (Electric Power Res. Inst., Palo Alto, CA, USA).
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.111-29
The authors consider recent work on the development of the disturbance analysis and surveillance system (DASS) of the Electric Power Research Institute (EPRI), Palo Alto. The work at EPRI covered a BWR application and the development of advance concepts as applied to a PWR. The authors start by considering the environment in which the DASS developments are taking place, especially the effect of observations resulting from evaluations of the safety parameter display system (SPDS) in actual control rooms. It is pointed out that insights are being gained into the behaviour of reactor control room crews. Both the philosophy and characteristics of the displays for the PWR and BWR DASS applications are discussed and pictures of the actual displays are included. The development and execution of a human factors plan is an integral part of the EPRI DASS programme and some discussion of the plan is included. It is concluded that there is a need for DASS-type systems and that such systems might be developed from an enhanced SPDS which would include the newly proposed emergency procedures based on identification of symptoms rather than events. (13 refs.)

117663 Computer-aided core surveillance and control. D.Beraha, A.Hoeld, O.Lupas (Gesellschaft fur Reaktorsicherheit mbH, Garching, Germany), O.Berg, K.Haugset, S.Hval, R.Moen, U.Scot Jorgensen.
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.131-50
The purpose of the core surveillance and control system described is to provide the operator with relevant information on the actual core state, to predict core behaviour in transient situations, to determine strategies for control of both power and power distribution, and to realize these strategies in an online control mode. Thus, the safety of the plant is improved since undesired core conditions can be prevented more easily. An outline of the main tasks of a core surveillance system is given, followed by a description of the modules developed, namely core simulators in the core follow mode and predictive mode, strategy generators, databases, and interactive operator communication. (23 refs.)

117664 Application of artificial intelligence to the detection and diagnosis of core faults in fast reactors. G.le Guillou, C.Berlin (CEA, Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-lez-Durance, France), J.-P.Parcy.
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.173-86 In French.
An automatic diagnostic system designed specially for fuel assembly accidents in fast reactors of the French type is described. It has an 'expert system' structure and, at the present stage of the project, is operating on a laboratory scale in an experimental unit (Solar 16/65). The software aspects of the development of such systems (structure and formulation of rules, language, etc.) are presented in detail. Various simulation tests are outlined. 'Real-time' application of the system will begin in 1983 on the Phenix reactor. (15 refs.)

117665 Diagnostic technologies for PWR plants in Japan. T.Masui (Mitsubishi Atomic Power Industries Inc., Tokyo, Japan), H.Morimoto, T.Ogino.
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.203-22
The improvement of the reliability and availability of nuclear power plants is an important subject. In this connection, it is of special importance to try and improve man-machine interfaces, i.e. to collect, systematize and diagnose the vast amount of plant information and to assist plant operators in the proper operation of nuclear power plants. The authors outline the diagnostic techniques of a computerized operator support system for PWR nuclear power plants under development as part of a five-year project. This project was initiated in 1980 and is supported by the Japanese Ministry of International Trade and Industry (MITI). The detection of abnormal conditions, the diagnostic prediction function and the system configuration are outlined. (3 refs.)

117666 STAR disturbance analysis system. W.Bastl (Gesellschaft fur Reaktorsicherheit mbH, Garching, Germany), R.Heinbuch, M.Kraft.
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.223-33
The STAR application in the Grafenrheinfeld 1300 MW(e) PWR has been completed. The system was to inform the operators of disturbances, their causes and their consequences. The project was to show feasibility as well as realizability of the above goals by means of a process computer. The authors describe the results achieved and the problems that have arisen. Based on the experience of this application, further investigations, recommendations and research work is proposed. (8 refs.)

117667 Development of a computerized operator support system. H.Yoshitoshi (Mitsubishi Heavy Industries Ltd., Tokyo, Japan), K.Noh, Y.Hirakochi, Y.Okamoto, M.Itoh, K.Monta.
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.235-49
A project for the development of a computerized operator support system (COSS) was initiated in 1980 and is supported by the Japanese Ministry of International Trade and Industry. This five-year development project covers BWR and PWR plants. The conceptual designs for these systems have been established and the detailed designs are being completed and implemented. The prototype systems will be tested and validated using large-scale plant simulators especially built for this project. The authors present the results of conceptual design, mainly with regard to monitoring, diagnosis and operational guidance technologies. The system will cover normal plant operation as well as abnormal, transient and accident modes. The outline of the system configuration and the method of verification with a plant simulator are also discussed. It is expected that the completed project and the application of COSS in nuclear power plants will contribute considerably to increased reliability and availability of these plants. (10 refs.)

117668 Analysis of the operator's tasks: an aid to control room design. P.Blanc, G.P.Guesnier (Electricite de France, Paris, France), B.Heilbronn, B.Monnier.
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.251-63 In French.
In order to study and design control rooms for its future PWR units, Electricite de France analysed the operator's tasks. By analysing the control procedures of the 900 MW PWR units already in operation, a data base describing the control and monitoring tasks performed by operators in normal, incident and accident situations has been built up. The database files, which were established from a study of 130 control procedures, record all the commands given and data available in the control room (about 7000), describe the tasks connected with these commands and data, and identify the times at which they are made use of by the operator. Using this database, the principle of operator-system communication and of data processing in the control room of the future has been established: in such a control room, most controls and data will be accessible through computer communication systems to ensure that control and monitoring systems are closely integrated under normal operating conditions as well as in incident and post-accident situations and to enable the plant to be controlled by one or two operators in a seated position. (no refs.)

117669 An approach to the design of an advanced control centre. K.Subramaniam, R.N.Ray (Reactor Control Div., Bhabha Atomic Res. Centre, Trombay, Bombay, India).
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.265-84
Control-room design deficiencies are to a considerable degree responsible for operator errors that lead to accident situations in nuclear reactors. The consideration of human factors, coupled with the use of advanced computer and display technology, result in optimum integration of the operator in the process. The authors describe the methodology adopted for the design of an advanced control centre for Indian PHWRs. The design of a human-engineered safety centre for the Narora PHWR station is discussed; stepwise schematic flow diagrams were used on the basis of an analysis of the safety functions. The factors involved in the design and validation of the operator-process interface are also outlined. Cathode ray tube displays are used as the main information display media in the advanced control centre. Displays ranging from macroviews of the plant systems to microviews of plant components help the operator in monitoring, control and diagnosis tasks. Human factors to be considered in the design of effective display formats are discussed and design guidelines summarized. (7 refs.)

117670 Defence in depth by 'Leittechnique' systems with graded intelligence. W.Aleite (Kraftwerk Union AG, Erlangen, Germany).
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.301-19
In the past, only two types of nuclear power plant instrumentation and control systems were in use in the Federal Republic of Germany (FRG): safety systems and operational systems. Present nuclear power plant 'Leittechnique' systems in the FRG have been expanded to multiple-grade systems with respect to safety, qualification requirements and intelligence. The extensive experience of the past has encouraged differentiation between the protection limitations and condition limitations of the reactor protection system on one hand and the information systems (including the accident monitoring and alarm system) of different safety importance on the other. This simplifies the introduction of computerized equipment, especially in the lower safety categories. Status, background and reasons of the introduction, as well as typical defence-in-depth modes, of the first running Leittechnique system of this kind (in the Grafenrheinfeld nuclear power plant) and especially their different tasks in disturbance handling are described. The international situation and future developments are briefly characterized. (9 refs.)

117671 A CMOS-logic-based reactor instrumentation system. J.E.Carpenter (Fisher Controls Ltd., London, England), K.Lillie.
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.321-37
The authors describe a control and instrumentation (C&I) system for nuclear reactors. In the equipment design, a standard 'building block' technique was adopted so that a wide range of measurements for reactor safety equipment

could be provided from standard plug-in cards and modules fitted in rugged purpose-designed racks. CMOS (complementary metal oxide semiconductor) digitally based equipment was selected for this application after extensive evaluation of other technologies. The racks contain all the electronics so that sensors are just passive components, i.e. there are no driver circuits in the containment area. A particular system is described which is arranged as four identical redundant subsystems and one set of on-line test equipment, but this is only one of many possible arrangements. (no refs.)

Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium ....See Entry 116928

Computer-calculated potential pH diagrams to 300°C. Vol.II: Handbook of diagrams ....See Entry 116935

VIPRE-01: A thermal-hydraulic analysis code for reactor cores. Vol.III: Programmer's manual ....See Entry 117595

Assessment, development, and application of LMFBR thermal-hydraulic analysis tools ....See Entry 117596

Numerical simulation of steam separators used in nuclear steam generators and reactor systems. Vol.II: User's manual ....See Entry 117597

Steam generator data base ....See Entry 117598

Modeling air-water tests with DUVAL ....See Entry 117599

Computer calculated potential pH diagrams to 300°C. Vol. III: User's guide for the computer program POT-pH-TEMP ....See Entry 117600

Testing ENDF/B-V data for thermal reactors (Addendums 1, 2, 3) ....See Entry 117601

Model investigations on core monitoring in large pebble-bed HTGRs using fast fission chambers in the top reflector ....See Entry 117602

Nuclear fuel conversion characteristics in a nuclear power station in a fuel cycle with two compositions of cycling fuel ....See Entry 117611

Theoretical investigation of the operation of cermet fuel elements in a BRIG-300 fast reactor ....See Entry 117612

Chromatographic determination of gas-like impurities in a dissociating coolant ....See Entry 117613

Experimental investigation of heat exchange and hydraulic resistance during air flow in fuel element bundle cells ....See Entry 117614

Evaluation of BWR resin intrusions on stress corrosion cracking of reactor structural materials ....See Entry 117618

EPRI research in qualification of safety-related electrical equipment ....See Entry 117674

Optimization of the man-machine interface for LMFBRs ......See Entry 117675

Thermal shock—new nuclear-reactor safety hazard? ....See Entry 117679

Improvements in the control and monitoring of PWR pressure vessels in post-accident situations ....See Entry 117685

A plant protection interlock system for the United Kingdom Prototype Fast Reactor ....See Entry 117686

Design and implementation of a computerized system for evaluation of plant status with respect to safety technical regulations ....See Entry 117687

Post-accident diagnosis system ....See Entry 117688

Diagnostic system for nuclear power plant operation ....See Entry 117689

Information provided to the operator via visual display screens: optimization of alarm signals ....See Entry 117690

28.44 FISSION REACTOR PROTECTION SYSTEMS, SAFETY AND ACCIDENTS

117672 Canadian approach to nuclear power safety. R.J.Atchison, F.C.Boyd, Z.Domaratzki (AECB, Ottawa, Ontario, Canada).
Nucl. Saf. (USA), vol.24, no.4, p.439-58 (July-Aug. 1983).
The development of the Canadian nuclear power safety philosophy and practice is traced from its early roots at the Chalk River Nuclear Laboratories to the licensing of the current generation of power reactors. Basic to the philosophy is a recognition that the licensee is primarily responsible for achieving a high standard of safety. As a consequence, regulatory requirements have emphasized numerical safety goals and objectives and minimized specific design or operating rules. In this article the Canadian licensing process is described with a discussion of some of the difficulties encountered. Examples of specific licensing considerations for each phase of a project are included. (30 refs.)

117673 Bayesian estimation of core damage frequency incorporating historical data on precursor events. C.D.Heising (Dept. of Nuclear Engng., MIT, Cambridge, MA, USA), A.Mosleh.
Nucl. Saf. (USA), vol.24, no.4, p.485-93 (July-Aug. 1983).
Data from a recent report analyzing precursors to severe core damage accidents are presented as additional evidence combined with the results of engineering risk analyses through the use of Bayes' theorem. Calculations are performed based on various definitions of increasing core damage: mild to severe core damage (no melting of fuel), full-scale core melt, and worse-case accidents. The Reactor Safety Study alone and combined with other published probabilistic risk assessment study results is also used. Assuming various core damage levels exist, the result of the Bayesian calculations indicate that the evidence, including precursor events, may not alter significantly core damage frequency estimates. (9 refs.)

117674 EPRI research in qualification of safety-related electrical equipment. G.E.Sliter (EPRI, Palo Alto, CA, USA).
Nucl. Saf. (USA), vol.24, no.4, p.494-505 (July-Aug. 1983).
Environmental qualification of safety-related electrical equipment easily qualifies for the top-10 list of issues in nuclear power safety during the past decade. The author gives an overview of what qualification is and is not, why qualification requirements may have reached a point of diminishing return in terms of improved safety, and how the research sponsored by utilities through the Electric Power Research Institute (EPRI) is helping them to meet growing qualification requirements in a technologically consistent manner and at minimum cost. Results to date from five EPRI research efforts are summarized: a review of equipment-aging technology, a comptuterized equipment qualification databank, radiation effects on organic materials in plant equipment, shake-table tests to examine the need for ageing before seismic qualification, and hydrogen burn tests to determine the conditions under which qualified equipment can survive degraded-core accidents. (36 refs.)

117675 Optimization of the man-machine interface for LMFBRs. S.E.Seeman, R.W.Colley (Westinghouse Hanford Co., Richland, WA, USA), R.C.Stratton.
Nucl. Saf. (USA), vol.24, no.4, p.506-12 (July-Aug. 1983).
An effort is under way to optimize the roles of man and machine in control of liquid-metal-cooled fast breeder reactors. The work reported here describes two systems: (1) MIDAS, presently in use, is a large data base system developed for the Fast Flux Test Facility (FFTF) as an aid to operators in determining how to proceed with maintenance and repairs on plant components and (2) the Procedure Prompting System is being developed to demonstrate a new methodology for automatically generating instructions to aid plant recovery in off-normal conditions. Methodology for this system has been demonstrated on a model of a small subsystem of FFTF. (4 refs.)

117676 Pressure vessel thermal shock: experience at US pressurized-water reactors, 1963-1981. D.L.Phung (Inst. for Energy Analysis, Oak Ridge Associated Univ., Oak Ridge, TN, USA), W.B.Cottrell.
Nucl. Saf. (USA), vol.24, no.4, p.520-33 (July-Aug. 1983).
The authors summarize the results of a study whose purpose was to identify and analyze events at US pressurized-water reactors (PWRs) which either resulted in or could be considered as precursors to pressure vessel thermal shock (PVTS). The data base includes ~16000 Licensee Event Reports on 47 PWRs, covering ~329 reactor-years from 1963 through 1981. The 99 identified events were assigned to one of five categories of severity. On this basis, 34 of the events were considered significant to PVTS. The events are categorized by cause and by vendor of the plant at which the event occurred. Some probabilistic risk assessment data are also developed. (8 refs.)

117677 Salem breaker incident.
Nucl. Saf. (USA), vol.24, no.4, p.540-4 (July-Aug. 1983).
After the failure in the scram system at unit 1 of the Salem Nuclear Generating Station in February 1983, the Nuclear Regulatory Commission (NRC) established a task force to conduct a fact-finding investigation of the incident. They found that maintenance and testing procedures for the scram system were inadequate. NRC bulletins were issued to alert the industry and induce better maintanance and testing. (4 refs.)

117678 A finite element quasi-Eulerian method for three-dimensional fluid-structure interactions. R.K.Kulak (Reactor Analysis & Safety Div., Argonne Nat. Lab., Argonne, IL, USA).
Comput. & Struct. (GB), vol.18, no.2, p.319-32 (1984).
A quasi-Eulerian approach is used in the development of a three-dimensional hydrodynamic finite element. With this approach the motion in the computing grid may be different from the motion of the material. Within each element the field variables are represented by trilinear interpolation functions and the pressure field is assumed to be constant. This leads to a set of simple relations for internal nodal forces that are easily coded and computationally efficient. Because the formulation is based upon a rate approach it is applicable to problems involving large displacements. The technique of degeneration is applied to the hexahedron to generate a pentahedral element. The use of the hour-glass dissipating nodal-forces for mesh stabilization is discussed. The procedure used to couple the fluid and structural domains of a problem is presented. The above method is applied to a three-dimensional, fluid-structure interaction problem in the area of reactor safety. (24 refs.)

117679 Thermal shock—new nuclear-reactor safety hazard?. E.Edelson.
Electron. Aust. (Australia), vol.45, no.8, p.12-17 (Aug. 1983).
Coolant water from the accumulator flooding into older reactor vessels during an emergency may create abrupt temperature and pressure changes, cracking steel walls or weld joints weakened by prolonged exposure to neutrons. In this pressurized-water reactor, water is pumped through the core and transfers heat to a steam generator. The full facts on this possible safety hazard are given. (no refs.)

117680 Analytic redundancy for online fault diagnosis in a nuclear reactor. A.Ray, R.Geiger, M.Desai, J.Deyst (Charles Stark Draper Lab. Inc., Cambridge, MA, USA).
J. Energy (USA), vol.7, no.4, p.367-73 (July-Aug. 1983).
A computer-aided diagnostic technique has been applied to online signal validation in an operating nuclear reactor. To avoid installation of additional redundant sensors for the sole purpose of fault isolation, a real-time model of nuclear instrumentation and the thermal-hydraulic process in the primary coolant loop was developed and experimentally validated. The model provides analytically redundant information sufficient for isolation of failed sensors as well as for detection of abnormal plant operation and component malfunctioning. (10 refs.)

117681 Risk assessment in reactors. N.Saqib (Karachi Nuclear Power Plant, Karachi, Pakistan).
Nucleus (Pakistan), vol.20, no.1, p.19-21 (Jan.-March 1983). [received: Oct. 1983]
The Maximum Credible Accident approach used for reactor safety assessment in the past has proved inadequate and a Probabilistic Approach has now caught the fancy of the scientific world. This paper introduces the newer approach. (4 refs.)

117682 LOCA hydroloads calculations with multidimensional nonlinear fluid/structure interaction. Vol.IV. Fluid/structure interaction application studies. F.H.Chang, G.A.Mortensen, G.E.Santee,Jr., G.F.Brockett, M.Gross, T.Belytschko.
Report EPRI-NP-1401, Electr. Power Res. Inst., Palo Alto, CA, USA (May 1983), 72 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA, USA.
The authors describe the application of a three-dimensional nonlinear fluid-structure interaction methodology to the calculation of the structural response of pressure vessel internals during a postulated loss-of-coolant accident. Results of the PWR/HDR calculation are compared with the HDR V31.1 test results, and the transient response of the fuel bundle is presented.

117683 Spray removal of fission products in PWR containments. D.R.Grist.
Report SRD R 267, UKAEA, Culcheth, Lancs., England (Nov. 1982), 61 pp.
Containment spray systems are provided in PWR containments to condense steam and to remove fission products from the containment atmosphere under accident conditions. This report provides models and parameters for assessing the rate and extent of removal of various fission product species. A range of droplet sizes and of spray additive options is considered and removal of vapour phase inorganic iodine species, of organic iodides and of aerosols containing fission products is discussed. Aerosol removal is assessed in terms of contributing removal mechanisms and the removal rate modelled as a function of the radius of the aerosol particulate species. (11 refs.)

117684 Safety system backfitting. G.B.Karlsson (Asea-Atom AB, Vasteras, Sweden).
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.57-67
In recent years, the necessity of physical separation of equipment to achieve redundancy and fire protection of a passive character has been emphasized. In order to improve the passive fire protection in the first Swedish commercial nuclear power plant, Oskarshamn-1, a project for cable separation and safety system upgrading has been executed. Oskarshamn-1 is an 'old' plant and therefore a number of backfitting projects have been considered; the author deals with one of the largest and most important backfitting projects and describes the basic technical principles applied in the design phase and the feedback achieved as a result of the project. (no refs.)

117685 Improvements in the control and monitoring of PWR pressure vessels in post-accident situations. B.Appell, R.Marcille, B.Perrin (Electricite de France, Paris, France).
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.69-78 In French.
Post-accident instructions based on initial events do not cover multiple equipment or human failures. Only instructions which are based on the status of physical parameters and changes occurring in them can cover the entire range of possibilities. A study of new instructions of this type has led to: (1) the design of a logic diagram for continuous monitoring for each state; this logic diagram is applied by the safety engineer, independently of the instructions for each event followed by the operators; the safety engineer may insist on the application of emergency instructions if certain specifications are exceeded; and (2) the inclusion in the event instructions of elements of the approach, whereby control procedures are determined by the plant state. In anticipation of the final results of the study, both the content (realistic post-accident developments have been taken into account) and the form (following a study of operator behaviour on simulators) of event instructions have been improved. Three computer-operated communication and information stations constitute the 'safety panel'. They present concise and detailed information to assist operators, the safety engineer and the team of emergency control experts whom the plant director can assemble if required. (no refs.)

117686 A plant protection interlock system for the United Kingdom Prototype Fast Reactor. D.Hodgson, N.T.C.McAffer (Systems Engng. Design Office, UKAEA, Risley, England), M.A.Read.
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.79-89
The development of operating procedures for the prototype fast reactor and general plant commissioning has shown that some of the original systems lacked flexibility and changes are now considered desirable to meet the current-needs. The authors describe recent work carried out to improve and extend the protection system associated with the secondary sodium circuits and steam generators, by the provision of a completely new programmable system sited in the central control room area. Connection to the plant continues to use the original cables and cubicles as marshalling frames for all input and output signals. The new control logic is based on programmable logic controllers operating in a majority-vote mode with final plant drive signals being provided by electromagnetic relays. Programming is carried out with the aid of a microprocessor development system away from the plant, and all the programs and modifications are stored on floppy discs. (no refs.)

117687 Design and implementation of a computerized system for evaluation of plant status with respect to safety technical regulations. F.Dworzak, A.Nedelik (Osterreichisches Forschungszentrum Seibersdorf GmbH, Seibersdorf, Austria), P.A.Van Gemst.
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.151-8
The authors describe the development, implementation and evaluation of the pilot version of a computerized system which supervises the operability of plant safety systems during normal plant operation. The system has been designed for use by the reactor operating staff and supplies the operator with comprehensive information on both the present situation and the operability of systems by performing a fast evaluation of the plant status. The system also indicates operational restrictions when any of the reactor safety systems are of restricted availability. Additionally, the system can be used for planning maintenance work and test activities as well as for training. Safety technical regulations are discussed and the principles of safety philosophies are briefly explained. The efforts with regard to the pilot project, which was implemented in the Forsmark-1 nuclear power plant in Sweden, are summarized. The results of this experiment are evaluated and recommendations for further improvements and future development work for full-scale application are outlined. (5 refs.)

117688 Post-accident diagnosis system. P.A.Van Gemst (ASEA-ATOM AB, Vasteras, Sweden), P.-O.G.Waessman.
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.159-71
The Swedish State Power Board will integrate a post-accident diagnosis system (PADS) of ASEA-ATOM design in the control rooms of its nuclear power plants Ringhals 1 and Forsmark 1 and 2. The authors describe the background for this decision, important design criteria and system design, and gives some examples of the proposed picture display. (no refs.)

117689 Diagnostic system for nuclear power plant operation. J.Wakabayashi, S.Tashima, A.Gofuku (Inst. of Atomic Energy, Kyoto Univ., Kyoto, Japan).
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.187-201
A diagnostic system for nuclear power plant operation was proposed and the applicability of this system to the actual plant verified by computer simulation. The diagnostic system is composed of three phases. In phase 1, a set of observed signals (observed vector) obtained from a plant is identified with one of the patterns (categories) representing normal operation and a number of anticipated anomalous situations; if there is no probable category, the observed vector is identified as an unanticipated anomalous state. If it is assumed that multiplex anomalies appear sequentially with some time interval, these anomalies are also identified in phase 1. When the observed vector is identified in phase 1 with one of the anticipated single or multiplex anomalous situations, the magnitude and time transition of the anomaly source is estimated in phase 2 on the basis of previous signals obtained from phase 3 (storage) and incoming signals. A χ^2-test and calculation of the normal probability density functions are carried out in phase 1, and the Kalman filtering technique is applied in phase 2. (6 refs.)

117690 Information provided to the operator via visual display screens: optimization of alarm signals. A.Seisdedos (Empresarios Agrupados, SAE, Madrid, Spain).
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.285-95 In Spanish.
Present-day computers can be used for a range of applications, one of which is the alarm system for a power plant. Generally speaking, the number of alarms generated is excessive in relation to the amount of data that the operator can handle. Furthermore, the display screens become overloaded with signals, as a result of which they become less effective and the operator loses track of the real status of the plant. It is, therefore, necessary to optimize the number of alarms and display screens in the system. One way is to establish degrees of priority for the alarms in order to exclude from the display from the display any signals which do not call for immediate action by the operator, although a case-by-case study cannot be entirely avoided. It is also desirable to program on the same computer a large package of graphic signals providing a complete overview of the plant. Alongside the above system, an optimised conventional alarm system, providing redundancy and support, is expedient. (no refs.)

117691 Computers in CANDU special safety systems. N.M.Ichiyen (Eng. Co., Sheridan Park Res. Community, AECL, Mississauga, Ontario, Canada).
Nuclear Power Plant Control and Instrumentation 1982. Proceedings of an International Symposium, Munich, Germany, 11-15 Oct. 1982 (Vienna, Austria: IAEA 1983), p.339-53
Computers hve been used in CANDU reactors for both direct digital control and control-room functions such as alarm annunciation, presentation of operating data, and data logging. However, until recently, computers were not used in the special safety systems. Recent designs have proposed computerization in all the safety systems, but implementation is most advanced in the two shut-down systems. The evolution of computers in safety systems has been in three stages: first, the monitoring of important shut-down system variables; secondly as programmable digital comparators which implement selected shut-down system functions; and thirdly the fully computerised shut-down system design being implemented in the Darlington A generating Station. (no refs.)

Reports, standards, and safety guides .... See Entry 116937

VIPRE-01: A thermal-hydraulic analysis code for reactor cores. Vol.III: Programmer's manual .... See Entry 117595

Cooldown performance capability of atmospheric steam dump system .... See Entry 117632

Prevention and mitigation of steam generator water hammer events in PWRs .... See Entry 117633

REWET-II facility for experiments on the loss-of-coolant accident in nuclear reactors .... See Entry 117634

Design and testing of a laboratory gamma-ray densitometer for two-phase flow .... See Entry 117639

Two-phase flow characteristics during controlled oscillation reflooding of a hot vertical tube .... See Entry 117641

Improving 900 MWe PWR control rooms .... See Entry 117659

Application of artificial intelligence to the detection and diagnosis of core faults in fast reactors .... See Entry 117664

STAR disturbance analysis system .... See Entry 117666

Development of a computerized operator support system .... See Entry 117667

Study of the effect of circumferential temperature variations on fuel-sheath strain in an inert atmosphere .... See Entry 120389

Occupational risks of energy production .... See Entry 120712

28.50 FISSION REACTOR TYPES AND APPLICATIONS

COMETHE-IIIJ predictions of the fuel centerline temperatures in the IFA-431, IFA-432, and IFA-513 assemblies .... See Entry 117594

Assessment, development, and application of LMFBR thermal-hydraulic analysis tools .... See Entry 117596

Steam generator data base .... See Entry 117598

Testing ENDF/B-V data for thermal reactors (Addendums 1, 2, 3) .... See Entry 117601

Model investigations on core monitoring in large pebble-bed HTGRs using fast fission chambers in the top reflector .... See Entry 117602

Radiation protection aspects in permanent decommissioning of the N.S. 'Otto Hahn' .... See Entry 117603

Assessment of flaw detection probability in the case of pressure vessel materials .... See Entry 117607

Nuclear fuel conversion characteristics in a nuclear power station in a fuel cycle with two compositions of cycling fuel .... See Entry 117611

Theoretical investigation of the operation of cermet fuel elements in a BRIG-300 fast reactor .... See Entry 117612

LWR core materials performance program: Progress in 1981-1982 .... See Entry 117616

Analysis of test lattice experiments in the light water high-conversion reactor PROTEUS .... See Entry 117617

Evaluation of BWR resin intrusions on stress corrosion cracking of reactor structural materials .... See Entry 117618

Performance of platinum self-powered neutron detectors in the simulated conditions of a pressurized water reactor .... See Entry 117631

Cooldown performance capability of atmospheric steam dump system .... See Entry 117632

Prevention and mitigation of steam generator water hammer events in PWRs .... See Entry 117633

REWET-II facility for experiments on the loss-of-coolant accident in nuclear reactors .... See Entry 117634

A review of condensate demineralizer regeneration procedures .... See Entry 117636

Chemical cleaning process evaluation - Westinghouse steam generators .... See Entry 117637

Evaluation of secondary-system layup and cleanup practices and processes .... See Entry 117638

State-of-the-art evaluation of condensate polisher performance .... See Entry 117640

Ultrasonic enhancement of chemical cleaning of steam generators .... See Entry 117642

Analysis of sludge from Indian Point 3 .... See Entry 117643

In situ calibration of nuclear plant platinum resistance thermometers using Johnson noise methods .... See Entry 117644

PWR model steam generator corrosion studies .... See Entry 117648

Evaluation and improvement of PWR secondary-system oxygen control measures .... See Entry 117651

Condensate polishing at Surry Nuclear Power Station .... See Entry 117652

Measurements of fast neutron fluxes in HTR-OTTO-core configurations and comparison with theoretical calculations (Detection of flux perturbation) .... See Entry 117654

Improving 900 MWe PWR control rooms .... See Entry 117659

Control-room mock-up for the Philippsburg nuclear power plant, unit 2 .... See Entry 117660

Exchange of plant computers at Ringhals 1: system philosophy and orgnaizational requirements .... See Entry 117661

Decision-making aid for operational crews: status of the EPRI DASS project .... See Entry 117662

Application of artificial intelligence to the detection and diagnosis of core faults in fast reactors .... See Entry 117664

Diagnostic technologies for PWR plants in Japan .... See Entry 117665

STAR disturbance analysis system .... See Entry 117666

Development of a computerized operator support system .... See Entry 117667

Analysis of the operator's tasks: an aid to control room design .... See Entry 117668

An approach to the design of an advanced control centre .... See Entry 117669

Optimization of the man-machine interface for LMFBRs .... See Entry 117675

Pressure vessel thermal shock: experience at US pressurized-water reactors, 1963-1981 .... See Entry 117676

Thermal shock—new nuclear-reactor safety hazard? .... See Entry 117679

LOCA hydroloads calculations with multidimensional nonlinear fluid/structure interaction. Vol.IV. Fluid/structure interaction application studies .... See Entry 117682

Spray removal of fission products in PWR containments .... See Entry 117683

Safety system backfitting .... See Entry 117684

Improvements in the control and monitoring of PWR pressure vessels in post-accident situations .... See Entry 117685

A plant protection interlock system for the United Kingdom Prototype Fast Reactor .... See Entry 117686

Post-accident diagnosis system .... See Entry 117688

Computers in CANDU special safety systems .... See Entry 117691

Mechanical properties of Cr-Ni steels and alloys after testing in N_2O_4 .... See Entry 120388

28.52 FUSION REACTORS

(for confinement, see 52.55)

117692 Prospects for fusion by 1995.
Fusion (USA), vol.5, no.3, p.9-16 (Sept. 1982). [received: Sept. 1983]
A review of current fusion programs is presented along with an assessment of the economic viability of polarised and unpolarised D-T reactors. (1 ref.)

117693 Technological methods in polarized fusion.
Fusion (USA), vol.5, no.3, p.17-22 (Sept. 1982). [received: Sept. 1983]
Technological methods for polarised fusion reactors are discussed, including pulsed operation and use of tandem mirrors. (2 refs.)

117694 Scientific frontiers in polarized fusion.
Fusion (USA), vol.5, no.3, p.24-7 (Sept. 1982). [received: Sept. 1983]
The problems of nuclear fusion are discussed, in particular the use of polarisation to control fusion. (1 ref.)

117695 A pellet model of DT ignitor and DD fuel for an ICF reactor without tritium breeding blanket. S.Ido (Inst. of Laser Engng., Osaka Univ., Osaka, Japan), T.Tazima.
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1194-9 (July 1983).
A pellet concept of a DT ignitor and DD fuel for an ICF reactor without a tritium breeding blanket is analytically examined under the condition that T is bred through the DD reactions. There is the additional restriction that the tritium breeding ratio in a pellet is unity, including the in situ DT burn in the DD region. Model calculations show that sufficiently high pellet gain can be obtained in a DT-DD pellet, when fuel ρR increases to ~ 40 g/cm^2 and the fraction of energy released in the DD region becomes dominant. One-dimensional neutronics calculations carried out for a reference pellet model with $\rho R \sim 40$ g/cm^2 show that the neutron heating in the compressed pellet model is evident and the total energy of the neutrons escaping from the pellet is reduced from ~ 2000 MJ to 330 MJ for a microexplosion of ~ 3000 MJ. (18 refs.)

117696 Preheating energy in a soft-X-ray-accelerated foil. H.Shiraga, S.Sakabe, K.Okada, T.Mochizuki, C.Yamanaka (Inst. of Laser Engng., Osaka Univ., Osaka, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L383-5 (July 1983).
Preheated temperature in a soft X-ray driven ablation was found by a double foil experiment to be $T_{ph}=2\sim 12$ eV for a 1.7 μm thick Al target at the incident X-ray irradiance of $I_x=10^{13}$ W/cm^2. This preheating was caused by the higher $h\nu$ component (~ 1 keV) of the soft X-ray spectrum. Its energy flux was also estimated to be $27\sim 260$ J/cm^2. (10 refs.)

117697 ECR-discharge cleaning for liner-containing Tokamaks. S.Ishii, K.Okazaki, Y.Sakamoto, K.Yano (Inst. of Phys. & Chem. Res., Saitama, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L403-5 (July 1983).
An experiment on electron-cyclotron-resonance (ECR) discharge cleaning was conducted in the TEXTOR device. A clean-up time for the liner was determined by estimating a total atomic flux integrated over spatial distributions of the ECR plasmas. It was proved that the vacuum components between the liner and vacuum vessel of tokamaks can be cleaned by this method. (8 refs.)

117698 Time decay of electric fields probed by charged reaction products in six-beam symmetrical implosion experiments. J.Delettrez, A.Entenberg, Y.Gazit, D.Shvarts, J.Virmont, T.Bristow, J.M.Soures, A.Bennish (Lab. for Laser Energetics, Univ. of Rochester, Rochester, NY, USA).
Nucl. Fusion (Austria), vol.23, no.9, p.1135-41 (Sept. 1983).
Alpha-particle spectra have been measured with a time-of-flight detector in laser fusion experiments on the symmetrical illumination, six-beam ZETA laser system (Nd-doped phosphate glass, $\lambda=1.054$ μm). For a series of fast imploding targets, upward mean energy shifts of alpha particles were observed. These energy shifts were attributed to a time-varying electric field which charged reaction products experience as they pass through the corona of the imploding microballoon. A one-dimensional, two-temperature hydrodynamics code was used to simulate both the expanding corona and the imploding glass. The corona simulation gave rise to an electric field with a decay time of the order of the laser pulse width. The acceleration of alpha particles by this field satisfactorily accounted for their observed alpha-energy shifts. (15 refs.)

117699 A capillary discharge thermonuclear burner. R.A.McCorkle (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Nuovo Cimento B (Italy), vol.77B, ser.2, no.1, p.31-41 (11 Sept. 1983).
Transient behavior of high-power discharges in small-diameter capillaries is a means for obtaining thermonuclear burn. (26 refs.)

Electron cyclotron emission and absorption in fusion plasmas .... See Entry 118712

The engineering of magnetic fusion reactors .... See Entry 118746

Chemical sputtering of carbon by sub-eV atomic hydrogen: new results and a critical comparison with previous data relevant to fusion applications .... See Entry 120209

The use of metallic glasses in fabrication of ICF targets .... See Entry 120273

Mechanical properties of molybdenum coated with titanium carbide film .... See Entry 120506

Mechanical behaviour of TiC film coated on molybdenum by magnetron sputtering .... See Entry 120507

Quantitative determination of deuterium in laser fusion targets by inverse Raman spectroscopy .... See Entry 120690

28.80 RADIATION TECHNOLOGY, INCLUDING SHIELDING

(see also 87.60 Medical and biomedical uses of fields, radiations and radioactivity)

117700 The recovery of organic solvents from liquid scintillation waste. J.A.Mangravite, D.Gallis, R.Foery (West Chester State Coll., West Chester, PA, USA).
Am. Lab. (USA), vol.15, no.7, p.24-34 (July 1983).
The authors have demonstrated the feasibility of separating the organic solvents xylene and toluene from liquid scintillation wastes. The solvents are removed completely from the waste material by distillation, leaving behind most of the radioactive contaminants. While a small amount of radioactivity is seen in the distillate, the source of this contamination is either the cosolvent, 2-ethoxyethanol, or water. These materials can be completely removed from the xylene or toluene distillates by treatment with anhydrous $CaCl_2$. (8 refs.)

117701 Angular flux of 662 keV gamma-ray transport in water. J.Banai (Dept. of Mech. Engng., Liverpool Univ., Liverpool, England).
Atomkernenerg. Kerntech. (Germany), vol.42, no.3, p.181-5 (1983).
Establishing experimental angular benchmark data from a point isotropic Cs 137 source in an effectively semi-infinite medium of water, slight discontinuities of the differential energy and angle spectra were observed at the single-scattering cut-off-energy. These spectra were compared with values calculated using the code PIPE (Program Integrating Photon transport Equation) and earlier benchmarks. Exposure buildup factors were computed from the angular fluxes for a range of angles between 5 and 70 degrees for separations of 15, 30, 45, 60 and 75 cm between source and water surface. Furthermore, the energy range of scattered photons from a point source is derived from the Compton relation. (20 refs.)

117702 Az egesztestszamlalo scannelo meroelrendezesenek kalibracioja (Whole body counter scanning system calibration). A.Andrasi, E.Beleznay.
Report KFKI-1983-43, Hungarian Acad. Sci., Budapest (1983), 29 pp.
The calibration of the mechanically and electronically improved whole body counter has been performed. In scanning and scanning-end-stop methods the validity of the calibration data obtained for the former system was checked and found to be applicable also to the improved new system. For double detector profile, and rectilinear scanning systems, the influence of the point source location inside the phantom and of the source gamma energy on the linear spatial resolution and on the counting efficiency were investigated in the case of different collimators. It was found that more uniform vertical response can be obtained when the arithmetic or geometric mean of the double detector responses was taken into account for integrated total spectra or for full energy peaks respectively. In the given geometry and for gamma energy of 662 keV the point source efficiency varies in the range of 0.4-1.9 cps/γ Bq, while the spatial resolution changes from 4 to 25 cm depending on the type of collimator used. (3 refs.)

117703 Investigation of fission models for high-energy radiation transport calculations. T.W.Armstrong, P.Cloth, D.Filges, R.D.Neef.
Report JUL-1859, Kernforschungsanlage, Julich, Germany (July 1983), 71 pp.
An investigation of high-energy fission models for use in the HETC code has been made. The validation work has been directed checking the accuracy of the high-energy radiation transport computer code HETC to investigate the appropriate model for routine calculations, particularly for spallation neutron source applications. Model calculations are given in terms of neutron production, fission fragment energy release, and residual nuclei production for high-energy protons incident on thin uranium targets. The effect of the fission models on neutron production from thick uranium targets is also shown. (29 refs.)

117704 Method of risk assessment for a multi-plant site. R.F.White.
Report SRD R 273, UKAEA, Culcheth, Lancs., England (June 1983), 69 pp.
A model is presented which can be used in conjunction with probabilistic risk assessment to estimate whether a site on which there are several plants (reactors or chemical plants containing radioactive materials) meets whatever risk acceptance criteria or numerical risk guidelines are applied at the time of the assessment in relation to various groups of people and for various sources of risk. The application of the multi-plant site model to the direct and inverse methods of risk assessment is described. A method is proposed by which the

potential hazard rating associated with a given plant can be quantified so that an appropriate allocation can be made when assessing the risks associated with each of the plants on a site. (7 refs.)

117705 Theoretical concept for measuring doses from external radiation in radiation protection - A supplement. B.R.L.Siebert, R.Hollnagel, R.Jahr.
Report PTB-ND-21, Phys.-Tech. Bundesanstalt, Braunschweig, Germany (June 1983), 36 pp.
A previously published theoretical concept for measuring individual doses from external radiation in radiation protection is applied to the following topics: film dosemeters in photon dosimetry, finite distances between the radiation sources and the exposed individual, calibration procedures for individual dosemeters in practical situations in which the dosemeter can be calibrated for only a finite set of energy spectra and directions of incident radiations. (10 refs.)

10th Annual Conference of the Association for Aerosol Research (Gesellschaft fur Aerosolforschung) ....See Entry 116920

Radiation protection aspects in permanent decommissioning of the N.S. 'Otto Hahn' .... See Entry 117603

Gamma dose-rates from the maximum-rated spent fuel bundle in KANUPP ....See Entry 117610

Dekontamination von Komponenten stillgelegter Kernkraftwerke fur die freie Beseitigung (Decontamination of components of closed-down nuclear power stations for open air disposal) ....See Entry 117706

A rapid spectroscopic technique for determining the potential α-energy concentration of radon decay products .... See Entry 117723

Laser heating of thermoluminescent microdosimeters: prospects in application to imagery by ionizing radiations ....See Entry 121015

Method for the calculation of radon response characteristics of integrating detectors ....See Entry 121020

The measurement of low concentrations of radon in air .... See Entry 121021

Effects of ionizing radiation and review of the Young-Woollard document ....See Entry 121022

Automated system for measuring air-exchange rate and radon concentration in houses ....See Entry 121027

28.90 OTHER TOPICS IN NUCLEAR ENGINEERING AND NUCLEAR POWER STUDIES

117706 Dekontamination von Komponenten stillgelegter Kernkraftwerke fur die freie Beseitigung (Decontamination of components of closed-down nuclear power stations for open air disposal). G.Lorcher, W.Piel.
Report EUR 8704 DE, Comm. European Communities, Luxembourg (1983), v+116 pp. In German. Contract DE-B-009-D.
An important task during the decommissioning of nuclear power plant is the decontamination of contaminated matter to an extremely low residual level. This kind of treatment allows disposal at municipal refuse tips or recycling and, consequently, reduces the quantity of radioactive waste to be disposed of. In order to evaluate the economic aspects of such a decontamination procedure, an estimation of costs for final disposal is needed. Such a comparison between final disposal and decontamination treatment is possible only under the condition that for the two procedures examined all cost elements, such as cutting to reduce size, conditioning, packaging and transport, are taken into account. (31 refs.)

29.00 EXPERIMENTAL METHODS AND INSTRUMENTATION FOR ELEMENTARY-PARTICLE AND NUCLEAR PHYSICS

29.15 ELECTROSTATIC AND LINEAR PARTICLE ACCELERATORS

117707 LAMPF II. C.M.Hoffman (Los Alamos Nat. Lab., Los Alamos, NM, USA).
AIP Conf. Proc. (USA), no.102, p.3-8 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
A brief description of LAMPF II is presented. LAMPF II is a planned high intensity 16-32 GeV proton accelerator with LAMPF as the injector. Some of the physics which could be studied with LAMPF II is discussed. (7 refs.)

117708 The electron linear accelerator, a versatile source of radiation. U.Kneissl (Justus-Liebig-Univ., Giessen, Germany).
Atomkernenerg. Kerntech. (Germany), vol.42, no.3, p.151-6 (1983).
The different kinds of radiation (electrons, positrons, photons, neutrons) available at conventional electron linear accelerators and their performances are described. The capabilities of the new high duty-cycle facilities are discussed. (29 refs.)

117709 A pulsed electron accelerator with extraction of a broad beam into the atmosphere. M.A.Abroyan, P.M.Bogomazov, S.F.Zverev, S.L.Kosogorov, V.A.Lagutin, V.A.Rodichkin, A.D.Susarov, G.M.Tokarev, K.A.Sharkov (Electrophys. Apparatus Res. Inst., USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1065-7 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR),* vol.25, no.5, p.28-30 (Sept.-Oct. 1982). [received: Sept. 1983]
Design features and test results are presented for a pulsed electron accelerator producing a beam of cross section 20×80 cm^2 in the atmosphere. With an accelerating voltage of 240 kV and a pulse length of 40 μsec, the density of the beam current extracted into the atmosphere is 8 mA/cm^2 with an inhomogeneity in the current density distribution of $\leq 10\%$ over an area of 0.9 of the nominal area of the beam. (6 refs.)

117710 Measurement of the number of electrons in electron rings from infrared synchrotron radiation. Yu.M.Volkov, A.A.Mal'tsev, V.A.Sviridov, V.P.Fominenko, V.P.Chizhov (Joint Inst. for Nuclear Res., Dubna, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1080-3 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR),* vol.25, no.5, p.40-3 (Sept.-Oct. 1982). [received: Sept. 1983]
A method has been developed for measuring the number of electrons in electron rings used in the collective acceleration of ions. The measurement is made from the synchrotron radiation in the infrared region. The detector used for the synchrotron radiation was an integrated-circuit silicon photodetector and amplifier, built into a single housing. The photodetector was calibrated with a heat source, viz. an SIRSh 6-100 light-measuring lamp with a ribbon-shaped tungsten luminous element. The measuring method has been checked on the synchrotron at the Leningrad Institute of Nuclear Physics. (4 refs.)

117711 Investigation of the operation of a two-stage accelerator with an anode layer with one electrical power supply. A.F.Kovrizhko, I.N.Safronov, A.V.Semenkin.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.776-8 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR),* vol.23, no.6, p.48-51 (Nov.-Dec. 1982). [received: Sept. 1983]
The two-stage accelerator with an anode layer, which has high acceleration efficiency, has a fairly complex electrical supply system, consisting of two independent power supplies. This complex power supply limits the range of application of these accelerators. The authors describe the results of an investigation of the operation of a two-stage accelerator with an anode layer with a simplified electrical power supply containing one source and an RC-divider. (4 refs.)

Measurement of parameters of electron-ion storage rings ......See Entry 117716

Detection of synchrotron radiation under the conditions of pulsed noise ....See Entry 117737

29.20 CYCLIC ACCELERATORS AND STORAGE FACILITIES

(for plasma accelerators, see 52.75)

117712 The TRIUMF kaon factory. D.Bryman (TRIUMF, Vancouver, BC, Canada).
AIP Conf. Proc. (USA), no.102, p.9-14 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
A kaon factory, using TRIUMF as an injector, could provide beams of kaons, neutrinos and other particles 100 to 1000 times more intense that are available at existing machines in the 30 GeV range. Consequently experimental opportunities would arise for new studies involving CP violation, rare kaon decays and fundamental neutrino interactions. (25 refs.)

117713 The BNL AGS—a context for kaon factories. L.S.Littenberg (Brookhaven Nat. Lab., Upton, NY, USA).
AIP Conf. Proc. (USA), no.102, p.15-42 (1983). (Theoretical Symposium on Intense Medium Energy Sources of Strangeness, Santa Cruz, CA, USA, 18-21 March 1983).
The author discusses the use of the BNL-AGS as a kaon factory and the possible areas of experimental use. (20 refs.)

117714 The SuSe project—a heavy ion accelerator for intermediate energies. G.Hinderer, P.Kienle, W.Schott, U.Trinks, W.Wilhelm, E.Zech (Tech. Univ. Munchen, Garching, Germany).
Atomkernenerg. Kerntech. (Germany), vol.42, no.3, p.145-9 (1983). In German.
A project to open up the field of heavy-ion physics in the medium energy range using advanced methods is described. Various fields of physics which become accessible with medium energy beams of particles exceeding the pion production threshold are reviewed. The concept is derived from the requirement of high beam quality, i.e. small energy spread, short time structure and good emittances. The beam is carefully treated from the ion source to the experimental equipment in order to minimize possible deteriorations of its quality. An injector like the Munich 13-MV tanden accelerator followed by a superconducting sector cyclotron (SuSe) is an excellent combination to achieve this purpose for light and medium-heavy ions. (6 refs.)

117715 A precision current stabilizer for the main winding of a cyclotron for use in a multicoupled control system. V.I.Sakhno, P.P.Teplov, V.G.Tsyvinskii (Kiev Polytech. Inst., Kiev, Ukrainian SSR).
Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1067-9 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR),* vol.25, no.5, p.30-2 (Sept.-Oct. 1982). [received: Sept. 1983]
Details are considered of an automatic control system for the current in a multiwound cyclotron magnet. The current stabilizer for the main winding of a 240-cm isochronous cyclotron is used to show that the incorporation of an additional resistance-actuated control circuity provides the required stabilization accuracy, with scope for computer control. (4 refs.)

117716 Measurement of parameters of electron-ion storage rings. V.D.Inkin, A.A.Mozelev, V.P.Sarantsev (Joint Inst. for Nuclear Res., Dubna, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1074-80 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR),* vol.25, no.5, p.36-40 (Sept.-Oct. 1982). [received: Sept. 1983]
A system is described for mesuring the number of electrons and ions in a collective heavy-ion accelerator. The operating principle of the system is that of detecting bremsstrahlung γ rays produced during the interaction of electrons from the storage ring with the nuclei of neutral atoms and ions at different stages of filling of the ring with ions. (8 refs.)

Accelerator production of medically useful radionuclides .... See Entry 121007

29.25 PARTICLE SOURCES AND TARGETS, PREPARATION AND TECHNOLOGY

(see also 07.77 Particle production and handling; targets)

117717 Transport of the beam phase space with non-centrosymmetric configuration. Chen Yinbao, Xie Xi (Inst. of Atomic Energy, Acad. Sinica, Beijing, China).
Chin. J. Nucl. Phys. (USA), vol.5, no.3, p.279-86 (Aug. 1983). In Chinese.
A transport theory of the non-centrosymmetric beam phase space has been developed. The beam envelope of the non-centrosymmetric polygonal and convex close curve phase space is proved to be the same as the beam envelope of the equivalent centrosymmetric phase space defined by the given non-centrosymmetric phase space and its image phase space with respect to the

origin of the coordinates as well as their common external tangents taken together. Thus the beam envelope of the non-centrosymmetric polygonal and convex close curve phase space is determined uniquely by the vertices and the parts of curve at the periphery of the so-defined equivalent centrosymmetric phase space, independently of those vertices and parts of curve within it. (1 ref.)

117718 Assay of radionuclide sources by energetic ion beams. I.V.Mitchell, D.Reher (Commission of the European Communities, Central Bur. for Nuclear Measurements, Geel, Belgium).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1277-90 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
The nondestructive analytical techniques of Rutherford backscattering and particle-induced X-ray emission spectrometry are described. Their application to the characterisation of thin radioactive deposits, prepared by different techniques, is illustrated by reference to recent examples carried out at the CBNM. (18 refs.)

117719 A magnetic-induction beam current transducer with shielding from magnetic interference. A.S.Kalinin, E.I.Shubin (Nuclear Phys. Inst., Acad. of Sci., Novosibirsk, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1070-4 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.5, p.32-5 (Sept.-Oct. 1982). [received: Sept. 1983]
A description is given of a magnetic-induction transducer for the beam current monitoring in a synchrotron acting as a booster for the VEPP-4 electron-positron system. The transducer operates with strong interference from the pulsed magnetic field in the synchrotron. Ways of reducing the interference level are considered. These measures enable one to monitor small beam currents (about 100 μA). (6 refs.)

117720 PHOBIS, a photon beam ion source for production of highly-charged ions. K.W.Jones, B.M.Johnson, M.Meron (Brookhaven Nat. Lab., Upton, NY, USA).
Phys. Lett. A (Netherlands), vol.97A, no.9, p.377-80 (26 Sept. 1983).
An ion source based on successive photoionization of trapped ions is now possible using high-brightness X-rays from a modern synchrotron storage ring. Calculations based on the design parameters for the National Synchrotron Light Source at Brookhaven indicate that degrees of ionization and beam intensities should be comparable to those achieved with existing EBIS, ECRIS, or recoil-ion sources. (9 refs.)

117721 Calculation of phase space compression by friction plus *RF* acceleration for charged particles. H.Daniel (Dept. of Phys., Tech. Univ. Munchen, Garching, Germany).
Z. Phys. A (Germany), vol.313, no.3, p.249-50 (1983).
Frictional phase space compression for charged particles is treated in closed form. The basic idea is to accumulate the particles in a 'synchrotron' with the frictional energy loss compensated on the average by RF acceleration and thus reduce the transverse phase space. (11 refs.)

117722 Muon flux measurement with silicon detectors in the CERN neutrino beams. E.H.M.Heijne.
Report CERN 83-06, CERN, Geneva, Switzerland (21 July 1983), viii+261 pp.
The neutrino beam installations at the CERN SPS accelerator are described, with emphasis on the beam monitoring systems. Especially the muon flux measurement system is considered in detail, and the calibration procedure and systematic aspects of the measurements are discussed. An introduction is given to the use of silicon semiconductor detectors and their related electronics. Other special chapters concern nonlinear phenomena in the silicon detectors, radiation damage in silicon detectors, energy loss and energy deposition in silicon and a review of energy loss phenomena for high energy muons in matter. (185 refs.)

A new high repetition rate shutter to obtain short molecular beam pulses ....See Entry 117278

Beam-energy distribution measurements of liquid gallium field-ion sources ....See Entry 117279

On the feasibility of performing neutrino experiments at an intense source of strangeness ....See Entry 117452

Third-order aberration-free ion-optical system for an electromagnetic isotope separator ....See Entry 117630

Investigation of fission models for high-energy radiation transport calculations ....See Entry 117703

A pulsed electron accelerator with extraction of a broad beam into the atmosphere ....See Entry 117709

A precision current stabilizer for the main winding of a cyclotron for use in a multicoupled control system ....See Entry 117715

Measurement of parameters of electron-ion storage rings ......See Entry 117716

Scintillator hodoscope system for a high intensity beam ....See Entry 117732

The design study of high voltage plasma focus for a large fluence neutron source by using a water capacitor bank ....See Entry 118769

Diagnostics of a plasma jet with grid electrodes ....See Entry 118770

29.30 RADIATION SPECTROMETERS AND SPECTROSCOPIC TECHNIQUES

117723 A rapid spectroscopic technique for determining the potential α-energy concentration of radon decay products. K.L.Revzan, W.W.Nazaroff (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Health Phys. (GB), vol.45, no.2, p.509-23 (Aug. 1983).
The application of α-spectroscopy to the rapid determination of the potential α-energy concentration (PAEC) of radon decay products indoors is considered. Two count totals are obtained after a single counting period. The PAEC is then estimated by a linear combination of the count totals, the two coefficients being determined by analysis of the dependence of the statistical and procedural errors on the equilibrium conditions and the sampling, delay and counting times. For a total measurement time of 11 min, the procedural error is unlikely to exceed 20% for equilibrium conditions commonly found indoors; the statistical error is less than 20% at a PaEC of 0.005 WL, assuming a product of detector efficiency and flow rate of at least 1.0l/min. (11 refs.)

117724 A versatile solid-state-detector spectrometer. D.Reher, W.Bambynek (Commission of the European Communities, Central Bur. for Nuclear Measurements, Geel, Belgium).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1301-9 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
The Low Energy X-ray and Electron Spectrometer (LEXES) has been designed for the simultaneous measurement of photons and electrons with windowless solid-state detectors. Within this spectrometer two detectors can be moved independently of each other with respect to the source plane. The source is introduced through an interlock system in order to keep the detectors constantly cooled and under high vacuum. Special techniques and materials have been chosen to reach the low operating temperatures of the detectors and to keep the consumption of liquid nitrogen at an acceptable level. LEXES has been used for the measurement of various parameters, and recently for the determination of conversion-electron ratios in the decay of ^{93m}Nb (Reher, 1982). As a further example of such measurements the redetermination of the relative K-capture probability P_K in the decay of ^{139}Ce is described. A value of $P_K=0.75\pm0.05$ has been found which is in good agreement with recent measurements (Hansen and Mouchel, 1975; Plch et al. 1975). (28 refs.)

Interfacing a transit-time mass spectrometer to a minicomputer ....See Entry 117273

X-ray fluorescence analysis using the Chem-X low power wavelength dispersive spectrometer ....See Entry 117305

Use of the α spectrometer to simultaneously measure the equilibrium of atmospheric daughters of Rn and Tn ....See Entry 120795

29.40 RADIATION DETECTORS

(for mass spectrometers, see 07.75)

117725 A comprehensive study of the yield of Cerenkov radiation in transparent media. F.M.Swailem, M.B.Moussa (Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo, Egypt).
Atomkernenerg. Kerntech. (Germany), vol.42, no.3, p.177-80 (1983).
A comprehensive study on the theoretical and experimental yields (counting efficiencies) of Cerenkov radiation is made using different radioisotope solutions and different transparent refractive media. The used radioisotope solutions are ^{32}P, ^{89}Sr, ^{99}Tc, ^{65}Zn, ^{54}Mn ^{131}I, ^{51}Cr, ^{137}Cs and ^{134}Cs and the used transparent media are distilled water, KBr solution, NaCl solution and glycerol. An automatic liquid scintillation spectrometer fitted with two bialkaline phototubes in fast coincidence circuit is used for counting Cerenkov radiations. A computer program is written to compute the theoretical yield of the radiations. The comparison between theoretical and experimental yields shows a largely satisfactory agreement. (8 refs.)

117726 Radon measurement intercomparisons. I.M.Fisenne, A.George, M.McGahan (Environmental Measurements Lab., US Dept. of Energy, New York, NY, USA).
Health Phys. (GB), vol.45, no.2, p.533-6 (Aug. 1983).
A description is given of the Evironmental Measurements Laboratory (EML) radon calibration chamber used for intercomparison of the methods for measurement of radon and radon daughters. Results are presented of the April and June 1981 radon intercomparisons. The participitating facilities, their sampler type and the detection system used are tabulated. The intercomparison results indicate reasonable agreement among the participating facilities at elevated radon concentrations;. (2 refs.)

117727 The intercalibration of a radon daughter detection system with a radon detection system. J.P.McLaughlin (Dept. of Phys., Univ. Coll. of Dublin, Dublin, Ireland), N.Jonassen.
Health Phys. (GB), vol.45, no.2, p.556-9 (Aug. 1983).
The need for intercalibrations to be made between radon and radon daughter detection systems is discussed. This is necessary if a fuller understanding of the mechanisms of partitioning of radon daughters in the indoor environment between the free, attached and plateout states is to be obtained. A method which was developed for making an intercalibration of this type is presented. It is a method which is easy to use and to adapt for use by other investigators for the intercalibration of their radon and radon daughter detection systems. (9 refs.)

117728 Operation of multigap projection-type spark chambers. B.M.Golovin, Yu.A.Gornushkin, V.S.Nadezhdin, N.I.Petrov (Joint Inst. for Nuclear Res., Dubna, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1088-95 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.5, p.47-52 (Sept.-Oct. 1982). [received: Sept. 1983]
The article describes the design of a multigap projection-type spark chamber. The dependence of the track structure upon both the amplitude and the direction of the cleaning field was established. The possibility of determining angles in space, which characterize the direction of a trajectory, from a single projection of a track was investigated. It was shown that it is possible to operate the multigap projection-type spark chamber with an internal target. The possibility of using multigap projection-type chambers for ionization measurements was studied. (16 refs.)

117729 A drift chamber for the identification of slow particles. Yu.Zlomanchuk, A.Navrot, V.A.Nikitin, V.D.Peshekhonov, M.Shavlovski (Joint Inst. for Nuclear Res., Dubna, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1095-101 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.5, p.53-8 (Sept.-Oct. 1982). [received: Sept. 1983]
The resolving power with respect to mass and charge was calculated for a drift chamber as a function of both number and thickness of the measuring channels for ^{4}He, ^{24}Mg, and ^{56}Fe ions with energies of up to 10 MeV/nucleon.The calculations show that the chamber allows reliable identification of the elements in the range $Z=1$-30. The isotope resolution, which is excellent for He and Mg ions, is noticeably worse for iron. (12 refs.)

117730 Calculation of the spatial resolution of scintillation hodosocopes built on the basis of hodoscope photomultipliers at various types of time matching. V.G.Vasil'chenko, V.G.Lapshin, E.A.Monich, A.I.Ronzhin, V.I.Rykalin.
Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1102-7 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.5, p.58-62 (Sept.-Oct. 1982). [received: Sept. 1983]
The Monte Carlo method was used to calculate the spatial distribution of scintillation hodoscopes built on the basis of photomultipliers at various types of time matching. The calculations have shown that in order to obtain the best spatial resolution of the scintillation hodoscopes, one must either extend the duration of a single-electron photomultiplier pulse to the optimum value $t_e\geq30$ nsec when threshold techniques of time matching and the method of a constant fraction are used or provide for matching to the center of gravity of the photomultiplier pulse. (13 refs.)

117731 Efficiency of recording thermal neutrons with semicondcutor detectors having planar convertors. N.O.Elyutin, V.K.Lyapidevskii, A.O.Nikitin, B.G.Perezhogin.

Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1107-10 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.5, p.62-4 (Sept.-Oct. 1982). [received: Sept. 1983]

The possibilities of building highly efficient semiconductor detectors with ^{6}Li and ^{10}B convertors for thermal neutrons are discussed. The experimental results obtained in research with silicon semiconductor detectors are analyzed. (5 refs.)

117732 Scintillator hodoscope system for a high intensity beam. M.De Palma, G.Macchia, G.Maggi, A.Ranieri, A.Sacchetti, G.Selvaggi, P.Spinelli.

Report INFN/TC-83/11, Ist. Naz. Fis. Nucl., Bari, Italy (16 May 1983), 9 pp.

Describes the construction and the operation of a scintillator hodoscope used in an intense beam. By using a fast scintillator (Pilot U), a XP1910 photomultiplier and an electronic chain, employing a fast Zero Crossing discriminator located close to the hodoscope and a differential discriminator as receiver in the counting room, a two pulse separation of 6 nsec per channel and a time resolution (σ) of 210 psec were obtained. (8 refs.)

117733 Major detectors in elementary particle physics. G.Gidal, B.Armstrong, A.Rittenberg.

Report LBL-91 Supplement (DE-AC03-76F00098), Univ. California, Lawrence Berkeley Lab., Berkeley, USA (March 1983), 86 pp.

This report is the first edition of a loose leaf compendium of the properties and performance characteristics of the major detectors of elementary particle physics.

What limits experiments in rare kaon decays: machines/beam lines or detectors? ....See Entry 117457

The recovery of organic solvents from liquid scintillation waste ....See Entry 117700

Az egesztestszamlalo scannelo meroelrendezesenek kalibracioja (Whole body counter scanning system calibration) ....See Entry 117702

Muon flux measurement with silicon detectors in the CERN neutrino beams ....See Entry 117722

Detection of synchrotron radiation under the conditions of pulsed noise ....See Entry 117737

Radiochemical isolation and radioactivity calibration of radium-228 by liquid-scintillation counting and gamma-ray spectrometry ....See Entry 118001

Role of molecular anions in the formation of complex centers in cesium iodide detectors ....See Entry 120117

Signal-to-noise ratio at the output of a flaw detector with a mosaic semiconductor hard X-ray detector and digital signal processing ....See Entry 120555

The measurement of low concentrations of radon in air ....See Entry 121021

29.60 COUNTING CIRCUITS AND NUCLEAR ELECTRONICS

117734 Interfacing the AI-4096 multidimensional analyzer to the Nairi-K computer. A.P.Zakharnev, N.B.Malevannaya.

Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1111-13 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.5, p.65-7 (Sept.-Oct. 1982). [received: Sept. 1983]

A method is described for interfacing the AI-4096 multidimensional pulse analyzer and the Nairi-K computer, permitting programmed data transfer between the devices. Data are transferred as an 18-bit binary code, and in practice, the data transfer rate is limited only by the computer speed, being $\geq$2000 numbers/sec. (6 refs.)

117735 Multichannel amplitude analyzer using the 'MERA-60' microcomputer. B.V.Fefilov, Nguen Hak Thi (Joint Inst. of Nuclear Res., Dubna, USSR).

Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1113-15 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.5, p.67-9 (Sept.-Oct. 1982). [received: Sept. 1983]

A 4096-channel amplitude analyzer based on the MERA-60/10 microcomputer and standard CAMAC modules is described. The system permits programmed automation of data collection and processing in activation analysis. Any 256-channel wide sector of the amplitude histogram can be displayed on the monitor screen, as can the addresses and contents of marker channels and other auxiliary information. Energy calibration and calculation of integral sums of specified spectral zones is possible, and various forms of hard copy output are provided. Up to eight spectral zones can be processed simultaneously. (14 refs.)

A high-speed, multi-input serial-interfacing system for a computer with simultaneous back-up recording on magnetic tape ....See Entry 117156

Interfacing a transit-time mass spectrometer to a minicomputer ....See Entry 117273

FASTBUS—a standard for the design of high-speed, fourth-generation electronic apparatus (review) .... See Entry 117740

29.70 RADIATION MEASUREMENT, DETECTION AND COUNTING

(see also 29.30 Radiation spectrometers and spectroscopy, 29.40 Radiation detectors; for dosimetry, see 87.60M)

117736 Application of two-stage 4π LS-γ coincidence method in the measurement of ^{75}Se activity. A.Chylinski, T.Radoszewski, T.Kempisty (Inst. of Atomic Energy, Swierk, Poland).

Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1175-80 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).

The main difficulty in ^{75}Se counting is due to a delay in gamma-ray emission of about 17 ms. The anticoincidence method cannot be used, as the delay is too significant. The coincidence extrapolation method has been applied with an efficiency function for X-ray and electron counting in a liquid scintillation (LS) coutner. The extrapolated counting rate contains the decay rate of ^{75}Se but also conversion electrons from the delayed gamma emission and some additional effect due to the efficiency of LS for the delayed gamma rays. This effect is determined by the first correction factor. The second correction factor is concerned with the Compton effect in a gamma-ray-counting channel of the scintillation counter with an NaI (Tl) crystal, i.e. scattered gamma rays from the delayed gamma rays. This effect cannot be avoided even if the channel window is set in such a way that the delayed radiation was not counted directly. The second correction factor was obtained from ^{51}Cr measurements, where the detector efficiency was calculated for the scattered gamma rays from the 320-keV gamma ray. (5 refs.)

117737 Detection of synchrotron radiation under the conditions of pulsed noise. V.M.Lachinov, A.A.Mal'tsev, V.P.Filin (Joint Inst. for Nuclear Res., Dubna, USSR).

Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1084-8 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.5, p.43-7 (Sept.-Oct. 1982). [received: Sept. 1983]

A two-channel system is described for the detection of synchrotron radiation in the prototype of a collective heavy-ion accelerator under the conditions of a higher level of electromagnetic noise. The radiation is recorded in the spectral region 0.4-4.5 μm in two channels, a silicon photodiode being the detector in one channel and a lead selenide photoconducting cell. Electromagnetic disturbances are effectively suppressed in the system. The amplitude of the synchrotron radiation is measured with a relative accuracy of 0.2%. (4 refs.)

117738 Experimental study of charcoal adsorptive technique for measurement of radon in air. M.Shimo, Y.Ikebe, J.Maeda (Dept. of Nuclear Engng., Nagoya Univ., Nagoya, Japan), R.Kamimura, K.Hayashi, A.Ishiguro.

J. At. Energy Soc. Jpn. (Japan), vol.25, no.7, p.562-70 (July 1983). In Japanese.

A method for sampling of Rn in air was experimentally studied. Radon gases flowing at 5 *l*/min are adsorbed on activated charcoal (5 g) in a column which is set in a coolant with dry ice and ethanol. The adsorbed Rn is transferred to an ionization chamber by heating the charcoal trap. The activity of Rn is then determined by the currents. The gross collection efficiency of this system was evaluated to be 0.88 ± 0.05 in the region of 50-1200 pCi/m^3. An example of measurements obtained by this method is presented. The air concentration of Rn in a closed room in found to be 4000-5000 pCi/m^3. (13 refs.)

117739 Search for massive magnetic monopoles by plastic track detectors. T.Doke, T.Hayashi, R.Hamasaki, T.Akioka, T.Naito (Sci. & Engng. Res. Lab., Waseda Univ., Tokyo, Japan), K.Ito, T.Yanagimachi, S.Kobayashi, T.Takenaka, M.Ohe, Nagata K., T.Takahashi.

Phys. Lett. B (Netherlands), vol.129B, no.5, p.370-4 (29 Sept. 1983).

A search for massive magnetic monopoles, predicted by the grand unified theories, has been performed using plastic nuclear track detectors (cellulose nitrate) with a total area of about 100 m^2, which were exposed at ground level for 3.3 yr. The effective solid angle for detection of monopoles is estimated over the velocity range $0.03c<v<0.2c$. An upper limit of 5.2×10^{-15} cm^{-2} s^{-1} sr^{-1} at 90% CL is obtained for the flux of unit magnetic monopoles with velocities higher than $0.04c$. (15 refs.)

Basis for application of the Campbell-method for stochastic signals ....See Entry 117145

A magnetic-induction beam current transducer with shielding from magnetic interference ....See Entry 117719

A drift chamber for the identification of slow particles ....See Entry 117729

Efficiency of recording thermal neutrons with semicondcutor detectors having planar convertors ....See Entry 117731

Major detectors in elementary particle physics ....See Entry 117733

Radiochemical isolation and radioactivity calibration of radium-228 by liquid-scintillation counting and gamma-ray spectrometry ....See Entry 118001

Average energy loss of 24.8-MeV electrons after passing through and backscattering from thick layers of C, Al, Cu, and Pb ....See Entry 119075

Method for the calculation of radon response characteristics of integrating detectors ....See Entry 121020

29.80 NUCLEAR INFORMATION PROCESSING

117740 FASTBUS—a standard for the design of high-speed, fourth-generation electronic apparatus (review). S.G.Basiladze (Joint Inst. for Nuclear Res., Dubna, USSR).

Instrum. & Exp. Tech. (USA), vol.25, no.5, pt.1, p.1041-64 (Sept.-Oct. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.5, p.5-27 (Sept.-Oct. 1982). [received: Sept. 1983]

A new standard is described for the design of high-performance multichannel electronic systems with distributed 'intelligence' that are based on the widespread implementation of large-scale integration (LSI) integrated circuits. The standard must serve as the structural and construction base of high-performance fourth-generation nuclear-physics apparatus. (11 refs.)

117741 Mathematical modelling for experimental physics data processing. A.N.Tichonov, V.Ja.Galkin.

In *Collection of scientific papers in collaboration with joint Institute for Nuclear Research, Dubna, USSR and Central Research Institute for Physics, Budapest, Hungary. Algorithms and programs for solution of some problems in physics. Vol.IV*, p.1-21. Report KFKI-1983-21, Hungarian Acad. Sci., Budapest (1983), 191 pp.

Statistical models for experimental physics data processing, mostly for gamma-interactions, are presented. Mathematical models of automatic measurements, hardware influence, multiplicity nuclear processes separation, Mossbauer spectroscopy and gamma-radiation kinetics are studied. Some direct and inverse problems formulations and decision results are discussed. (39 refs.)

A high-speed, multi-input serial-interfacing system for a computer with simultaneous back-up recording on magnetic tape ....See Entry 117156

Interfacing a transit-time mass spectrometer to a minicomputer ....See Entry 117273

A surveillance system for nuclear reactors based on sequential pattern recognition methods ....See Entry 117655

A new tool for nuclear reactor diagnostics ....See Entry 117656

Interfacing the AI-4096 multidimensional analyzer to the Nairi-K computer ....See Entry 117734

Multichannel amplitude analyzer using the 'MERA-60' microcomputer ....See Entry 117735

30.00 ATOMIC AND MOLECULAR PHYSICS

(for physical chemistry, see 82.)

31.00 THEORY OF ATOMS AND MOLECULES

(see also 71. Electron states in condensed matter)

31.10 GENERAL THEORY OF STRUCTURE, TRANSITIONS AND CHEMICAL BINDING

117742 Time-reversal symmetry, Kramers' degeneracy and the algebraic eigenvalue problem. N.Rosch (Lehrstuhl fur Theoretische Chem., Tech. Univ. Munchen, Garching, Germany).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.1-5 (Oct. 1983).
A method is presented whereby time-reversal symmetry may be fully exploited in systems exhibiting Kramers' degeneracy. A basis adapted to time-reversal symmetry, i.e. consisting of Kramers pairs, will be transformed into another of the same structure by symplectic unitary or, equivalently, by quaternionic unitary transformations. Only one quaternionic hermitean eigenvalue problem of half the original order has to be solved for each Kramers pair. This leads to a significant reduction of the necessary computational effort. (17 refs.)

117743 Geometries of van der Waals complexes of small polar molecules. J.T.Brobjer, J.N.Murrell (School of Chem. & Molecular Sci., Univ. of Sussex, Brighton, England).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1455-64 (Sept. 1983).
The geometries of most known van der Waals complexes between small polar molecules agree well with those calculated to be optimum for the electrostatic energy at the experimental intermolecular separation. This conclusion has been reached by calculating the electrostatic energy using a multipole-fitted point-charge model. (66 refs.)

117744 Numerical properties of the convolution theorems of *B* functions. E.J.Weniger, E.O.Steinborn (Inst. fur Phys. & Theoretische Chem., Univ. Regensburg, Regensburg, Germany).
Phys. Rev. A (USA), vol.28, no.4, p.2026-41 (Oct. 1983).
For the computation of convolution integrals of *B* functions [Eq. (2.14) of E. Filter and E.O. Steinborn, Phys. Rev. A 18, 1 (1978)] which are a special class of exponential-type functions, different analytic representations are available. The authors have investigated the numerical properties of these convolution formulas and found out that results of sufficient accuracy can be obtained for molecular calculations. They have also investigated the numerical properties of the corresponding one-center integrals. Some new mathematical properties of *B* functions that are essential for the understanding of the numerical properties of the convolution formulas are derived. (50 refs.)

117745 Modified-Hill-determinant method for the hydrogen molecular-ion problem. R.S.Bhattacharjee, R.P.Saxena, P.K.Srivastava (Dept. of Phys. & Astrophys., Univ. of Delhi, Delhi, India), K.V.Sane.
Phys. Rev. A (USA), vol.28, no.4, p.2042-50 (Oct. 1983).
The problem of the H_2 molecular ion is reinvestigated with the use of a method of truncated Hill determinants. Modified Hill determinants are found such that the truncations thereof form a convergent sequence. The wave functions obtained from the present formulation are expected to be more reliable than those reported earlier and in fact are shown to be orthonormal to one part in 10^6. Equilibrium bond lengths (R_e), stiffness constants, and the wave functions at R_e for various states are presented. (23 refs.)

117746 Effective shell charge of electrons on a sphere—a discussion of Hund's rules, negative ions and the chemical bond. H.Essen (Dept. of Chem., McMaster Univ., Hamilton, Ontario, Canada).
Theor. Chim. Acta (Germany), vol.63, no.4, p.365-76 (1983).
By ignoring the radial motions of the electrons in the valence shell of an atom one formally obtains the problem of electrons constrained to move on a sphere. This sphere will be attracted by the core as if it had an effective charge equal to the number of electrons on it minus a certain quantity resulting from the mutual repulsion of the electrons. This 'effective shell charge' is a very simple, but still precise and quantitative concept which provides a good understanding of many empirical facts about atoms and ions, most notably Hund's rules. Implications for negative ions are discussed and chemical bonding is touched briefly. A qualitative difference in physical behavior for small and large sphere radii is pointed out. (22 refs.)

117747 Energy-density relations in momentum space. II. Generalization. T.Koga, T.Miyahara, M.Morita (Dept. of Appl. Chem., Muroran Inst. of Technol., Hokkaido, Japan).
Theor. Chim. Acta (Germany), vol.63, no.4, p.377-81 (1983).
For pt.I see ibid., vol.59, p.639 (1981). Rigorous relations are derived between the electronic energy and the electron momentum density of a molecular system whose Hamiltonian takes the form of $g(\lambda)T(\{\mathbf{r}\})+h(\lambda)V(\{\mathbf{r}\};\{\mathbf{R}\})$ and depends on a parameter λ. (8 refs.)

117748 The periodic system for diatomic molecules: group-theoretical approach. G.V.Zhuvikin, R.Hefferlin.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.10-16 (Aug. 1983). In Russian.
The group-theoretical construction of the periodic system for diatomic molecules is suggested. Six quantum numbers are introduced for enumerating molecules. The system developed is in good agreement with the periodic system previously proposed on the basis of the tabulated data by Hefferlin and others (1979, 1980). (16 refs.)

117749 An analytic approximation for the energy levels of neutral atoms. R.Dutt (Dept. of Phys., Visva-Bharati Univ., Santiniketan, West Bengal, India), Y.P.Varshni.
Z. Phys. A (Germany), vol.313, no.3, p.143-5 (1983).
Using a screened Coulomb potential, a simple formula is obtained for the shell binding energy E_{ns} of a neutral atom which gives accurate results over the entire range of the atomic number upto 84. (10 refs.)

Critical behavior of a three-dimensional dimer model ....See Entry 117108

31.15 GENERAL MATHEMATICAL AND COMPUTATIONAL DEVELOPMENTS

117750 A new method for the calculation of the electronic properties of atoms and molecules. C.Valdemoro (Inst. de Fisica del Estado Solido, CSIC, Madrid, Spain).
An. Fis. Ser. A (Spain), vol.79, no.2, p.106-11 (May-Aug. 1983). [received: Oct. 1983]
The author presents the basic theory for the construction of a spin-adapted reduced-Hamiltonian matrix describing the electronic properties of an m-electron system. It is expected that the eigenvalues and eigenvectors of this matrix will led to the exact or good approximation values to the excitation energies of an m electron-system. (13 refs.)

117751 On determining the number of stochastic degrees of freedom in polyatomic molecules. J.R.Stine (Los Alamos Nat. Lab., Los Alamos, NM, USA), D.W.Noid.
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.282-6 (9 Sept. 1983).
Construction of dimensionality plots have proved useful for determining the number of integrals of the motion in dynamical systems with two and three degrees of freedom. The slow convergence in the method is caused by the trajectory not accessing phase space uniformly. Here an information dimension is shown to have better convergence properties. (15 refs.)

31.20 SPECIFIC CALCULATIONS AND RESULTS

117752 The formate anion: an ab initio study of its equilibrium structure, general harmonic force field and fundamental vibrational frequencies. A.R.Gregory (Dept. of Chem., West Virginia Univ., Morgantown, WV, USA), K.G.Kidd, G.W.Burton.
THEOCHEM (Netherlands), vol.13, no.1-2, p.9-22 (Sept. 1983).
The general harmonic force field (GHFF) of the formate anion has been calculated by ab initio restricted Hartree-Fock theory using the minimal STO-3G and split valence 4-31G basis sets. This work was carried out in conjunction with a previously reported experimental study in which the ion's force field was determined from its vibrational frequencies in polycrystalline sodium formate by an improved refinement procedure. The ab initio results reported proved valuable in the study as a guide to the true physical values of the harmonic force constants. (41 refs.)

117753 The relations between the valence angles of sp^3-hybridized central atoms for all possible local symmetries. B.Klahn (Lehrstuhl fur Theoretische Chem., Univ. Gottingen, Gottingen, Germany).
THEOCHEM (Netherlands), vol.13, no.1-2, p.49-77 (Sept. 1983).
The explicit analytic relations between the valence angles of sp^3 hybridized atoms are derived for the different cases of local symmetry (C_{2V}, C_s, C_1 and C_{3v}). These relations allow the calculation of all valence angles, if a complete set of independent angles is given. Restrictive conditions on the input data are also presented. Examples illustrate to what extent the derived formulae are obeyed by bond angles of molecular centres with coordination number four. (64 refs.)

117754 Ab initio study of rotational isomerism in cyclopropanecarboxaldehyde. G.R.De Mare, M.R.Peterson (Lab. de Chimie Phys. Moleculaire, Brussels Univ., Brussels, Belgium).
THEOCHEM (Netherlands), vol.13, no.1-2, p.115-30 (Sept. 1983).
The geometry of cyclopropanecarboxaldehyde has been optimized completely at each critical point in the torsional potential curve for −CHO group rotation by analytic gradient (force) methods at the STO-3G, 3-21G and 6-31G* basis set levels. In agreement with the available gas-phase electron-diffraction and microwave spectroscopy results, minima in the torsional potential energy curves are located only at the cis and trans conformations. The STO-3G basis computations place the cis 1.4 kJ mol^{-1} above the trans conformer and predict the barrier for the trans→cis rotation to be 13.8 kJ mol^{-1} at $\theta=99.3°$. The geometrical parameters obtained are compared with the corresponding values for vinylcyclopropane, acetaldehyde and glyoxal. Evidence is found for important geometry changes due to the attraction between the oxygen and adjacent ring hydrogen atoms in the cis-cyclopropanecarboxaldehyde rotamer. Electric dipole moments were computed with the optimized geometries at each critical point. (26 refs.)

117755 Parameterization of small basis set molecular orbital calculations for bond moment determination. B.J.McClelland, W.J.Orville-Thomas (Dept. of Chem., Univ. of Salford, Salford, England).
THEOCHEM (Netherlands), vol.13, no.1-2, p.147-53 (Sept. 1983).
A previously-described method of determining polar parameters of bonds from vibrational band intensities requires the estimation of the contribution of polarization terms to derivatives of the molecular dipole moment with respect to symmetry coordinates. A new procedure is proposed which uses ab initio minimum basis set molecular orbital calculations with valence shell orbital exponents scaled to reproduce the experimentally-determined dipole moment derivatives. The method is applied to the methane molecule and polar parameters of C-H bonds in this molecule are evaluated. (12 refs.)

117756 Tests of the orbital stasis and orbital following models. W.E.Palke, B.Kirtman (Dept. of Chem., Univ. of California, Santa Barbara, CA, USA).
THEOCHEM (Netherlands), vol.13, no.1-2, p.207-13 (Sept. 1983).
Two zeroth-order models of the orbital motion (i.e. the change in orbital direction) that occurs when a molecule bends have been proposed, namely orbital following and orbital stasis. These models are tested by comparing calculated parameters, which characterize the bending potential and electronic charge distribution, with experimental values for N_2O, NH_3, and H_2S. The available data, although somewhat limited, show a moderate-to-strong preference for orbital stasis. Additional tests are suggested. (15 refs.)

117757 Structures and conformations of cyclopentane, cyclopentene, and cyclopentadiene. S.Saebo, F.R.Cordell, J.E.Boggs (Dept. of Chem., Univ. of Texas, Austin, TX, USA).
THEOCHEM (Netherlands), vol.13, no.1-2, p.221-32 (Sept. 1983).
The structures and conformations of cyclopentane, cyclopentene, and cyclopentadiene have been investigated by SCF gradient ab initio computation with a double zeta basis set. For cyclopentane the half-chair (C_2) and the envelope (C_s) forms were found to be isoenergetic, consistent with the experimentally observed free pseudorotation. The barrier to coplanarity of the ring is 4.3 kcal mol^{-1}. Cyclopentene has a puckered C_s equilibrium conformation with a very low barrier to planarity. Cyclopentadiene has a planar ring. The compounds with 5, 3 and 1 methylene groups, respectively, show a decreasing tendency to form puckered rings as interaction between adjacent methylene groups becomes of less significance compared with the influence of angle strain which favors ring planarity. A corrected geometrical optimization of the half-boat (C_2) form of cyclohexane is also presented. (68 refs.)

117758 Polarizability and aromaticity of pyrimidine: a comment. G.L.D.Ritchie (School of Chem., Univ. of Sydney, NSW, Australia).
THEOCHEM (Netherlands), vol.13, no.1-2, p.247-50 (Sept. 1983).
The author comments on the recent attempt of Subbaiah et al. (ibid., vol.87, p.105, 1982) to elucidate the structure and aromaticity of pyrimidine by applying considerations of molecular polarizability to 2,4,6,-trifluoropyrimidine (1) and 2-amino-4,6-dichloropyrimidine (2). The author points out the paper appears to contain deficiencies which compromise the credibility of both the numerical results and the qualitative inferences drawn therefrom. (21 refs.)

117759 RHF-SCF-LCAO-MO calculations of the one-electron properties of H_2O, CH_3OH, CH_32CH_2OH. S.Tolosa Arroyo, F.J.Olivares del Valle (Dept. de Quimica Fisica, Univ. de Extremadura, Caceres, Spain).
An. Fis. Ser. A (Spain), vol.79, no.2, p.112-20 (May-Aug. 1983). [received: Oct. 1983]
One-electron properties of water, methanol and ethanol have been studied in order to gain insight on the dependence of the charge distribution localized at the O-H with respect to the radicals CH_3-, C_2H_5- and H-. Likewise, properties of the systems as a whole (multipolar moments and diamagnetic susceptibilites referred to the mass centre), have been investigated. The molecular wave function has been built by using a double-zenta basis according to the nonempirical RHF-SCF-LCAO-MO method. (25 refs.)

117760 The conformation of proline using the concept of pseudorotation. K.K.Chacko, S.Swaminathan, K.R.Veena (Dept. of Crystallography & Biophys., Univ. of Madras, Madras, India).
Curr. Sci. (India), vol.52, no.14, p.660-3 (20 July 1983).
Proline ring conformation based on best planes is only an approximate way of defining the conformation. A more rigorous approach is to use the concept of pseudorotation of the five membered pyrrolidine ring system. The authors develop a method of representation of the conformation based on the above concept. From the endocyclic torsion angles, the pseudorotational parameters p (phase angle) and τ_m (maximum amplitude of pucker) can be calculated. The true conformation of the proline ring is obtained by referring to the pseudorotational pathway chart. The conformation is conveniently represented by an abbreviated nomenclature. Sample data of pyrrolidine rings of 12 prolyl residues are given to bring out the salient features. (19 refs.)

117761 On the assignment of the HOMO in UF_6. N.Martensson, P.-A.Malmquist, S.Svensson (Inst. of Phys., Uppsala Univ., Uppsala, Sweden).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.375-7 (16 Sept. 1983).
Electron spectroscopic measurements provide strong evidence that the HOMO in UF_6 is of t_{1g} symmetry and not t_{1u} which has been generally assumed. (12 refs.)

117762 Semiclassical self-consistent field calculations of Feshbach resonance energies. A.D.Smith, W.-K.Liu (Dept. of Phys., Univ. of Waterloo, Waterloo, Ontario, Canada).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.461-5 (23 Sept. 1983).
Feshbach (compound-state) resonance energies are calculated for a model collinear collision system using the semiclassical self-consistent field method. Good agreement is obtained with previous accurate quantum, semiclassical and perturbation theory results. (22 refs.)

117763 Finite perturbation MCSCF and CI calculations of nuclear spin-spin coupling constants for some molecules with multiple bonds. A.Laaksonen, J.Kowalewski (Dept. of Phys. Chem., Univ. of Stockholm, Stockholm, Sweden), V.R.Saunders.
Chem. Phys. (Netherlands), vol.80, no.3, p.221-7 (15 Oct. 1983).
Nonempirical finite perturbation calculations at the Hartree-Fock, multiconfigurational self-consistent field and configuration interaction levels of approximation are presented for the Fermi contact contribution in multiply-bonded molecules ethene, formimide, formaldehyde, ethyne and hydrogen cyanide. The finite perturbation-multiconfigurational SCF (FPMC) method (with few configurations) is free from the UHF triplet instabilities normally present in single configuration coupled Hartree-Fock (CHF) calculations of the Fermi contact (and spin-dipolar) contribution for π-bonded systems. The behaviour of coupling constants, calculated using FPMC for multiply-bonded systems parallels the behaviour of the CHF coupling constants in comparable systems with single bonds only. The effects of dynamic electron correlations are important and are obtained using the CI method. After accounting for the orbital contribution by means of the single configuration CHF method, agreement with experiment is excellent for systems containing only carbon and hydrogen, when a double-zeta quality basis set is used. For systems containing nitrogen and oxygen agreement is still reasonable, but the use of larger basis sets seems to be necessary if good agreement with experiment is to be obtained. (39 refs.)

117764 A theoretical estimate for quasihomopolar singlet levels in long polyenes with a spin model hamiltonian. K.Hashimoto (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Chem. Phys. (Netherlands), vol.80, no.3, p.253-61 (15 Oct. 1983).
A spin model hamiltonian is employed to estimate the energy levels of quasihomopolar singlet states in long polyenes. To this end, the singlet excitation energies of the alternating spin chain are calculated as functions of γ and N using the Hartree-Fock method developed based on the spinless fermion formulism. The result indicates that the excitation energies decrease monotonically with increasing chain length in accord with the known experimental results. Using the parameters j and γ empirically determined from the data on short polyenes, an estimation is given for the energy levels of the lowest-lying 2^1A_g states as well as those of the second ^1B_u quasihomopolar states in long polymers. In particular, the 2^1A_g level in polyacetylene is predicted to be at 1.1 eV in good agreement with a recent photoluminescence result (1.19 eV). (31 refs.)

117765 Theoretical structure of the $B_2H_7^-$ anion. K.Raghavachari (Bell Labs., Murray Hill, NJ, USA), P.von Rague Schleyer, G.W.Spitznagel.
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5917-18 (7 Sept. 1983).
Previous ab initio calculations on $B_2H_7^-$, like those in the literature, appeared to favor a linear D_{3d} structure. The authors were intrigued by the apparent discrepancy with experiment. Larger basis sets with polarization functions and especially corrections for the effects of electron correlation favor bent over linear C-H-C bridges. Thus, definitive studies on $B_2H_7^-$ need a similar degree of sophistication, which was not employed in the prior theoretical investigations. They report the results of such an examination which confirms bent B-H-B structures to be favored. (15 refs.)

117766 Structure of an electronically stabilized carbonyl ylide. E.P.Janulis, A.J.Arduengo,III (Dept. of Chem., Univ. of Illinois, Urbana, IL, USA).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5929-30 (7 Sept. 1983).
The authors report the first structure determination of a stable carbonyl ylide, tetramethyluronium tetrakis(trifluoromethyl)cyclopentadienylide. A variety of analogous thione ylides have been synthesized, and many of these ylides are stable and isolable. The most stable of these thione ylides are stabilized by a 'push-pull' electronic substitution pattern, and complete structural studies are available on these systems. Early attempts to use the same stratagem to stabilize carbonyl ylides were unsuccessful. The absence of stable 'push-pull' carbonyl ylides has been bothersome from a theoretical point of view. The stabilizing influence of the electron-donating and -releasing groups on thione ylides is believed to act in concert with a sulfur conjugate link between the termini. The diminished ability of oxygen to function as a conjugative link demands that the substituent groups perform a cappella in stabilizing the carbonyl ylide. Thus, if stable carbonyl ylides are possible, exceedingly effective electron-releasing and -donating groups will be required. The authors chose to attempt the synthesis of a carbonyl ylide by the reaction of an electron-deficient-carbene with a carbonyl compounds. (7 refs.)

117767 Cli_5, CLi_6, and the related effectively hypervalent first-row molecules, $CLi_{5-n}H_n$ and $CLi_{6-n}H_n$. II. P.von Rague Schleyer, E.U.Wurthwein, E.Kaufmann, T.Clark (Inst. fur Organische Chem., Freidrich-Alexander-Univ., Erlangen-Nurnberg, Erlangen, Germany), J.A.Pople.
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5930-2 (7 Sept. 1983).
For pt.I see ibid., vol.104, p.5839 (1982). The octet rule predicts the stoichiometries of first-row hydrides remarkably well. Thus, 'CH_5' and 'CH_6' are only likely to exist as weak complexes between methane and a hydrogen atom or a hydrogen molecule. Surprisingly, when lithium is involved instead of hydrogen, the situation is completely different. Both trigonal-bipyramidal CLi_5 (1, D_{3h}) and octahedral CLi_6 (2, O_h) are indicated by ab initio calculations using the 3-21G basis set and full geometry optimization to be highly stable toward all possible dissociation reactions. The related series of molecules $CLi_{5-n}H_n$ (n=0-4) and $CLi_{6-n}H_n$ (n=0-5) behave similarly. A number of geometries were explored for each species; the lowest energy structures (with bond lengths and angles) are illustrated. Single point calculations with the larger 6-31G* basis set including correlation corrections at the MP2 level were performed on the smaller species. How is it possible for CLi_5, CLi_6, and the other hyperlithiated molecules to violate the maximum stoichiometry expected on the basis of the octet rule? The high symmeties and the C-Li distances in 1 and 2, only slightly longer than those found for CH_3Li (2.001 Å) or CLi_4 (1.929 Å) at 3-21G, show that all the lithiums are bound to carbon. Indeed, all these molecules exhibit the bonding that the authors find to be general for such hypermetalated species. (14 refs.)

117768 Bonding effects on the momentum densities of alkaline-earth oxides. B.S.Sharma, A.N.Tripathi (Dept. of Phys., Univ. of Roorkee, Roorkee, India), A.J.Thakkar.
J. Chem. Phys. (USA), vol.79, no.6, p.3164-5 (15 Sept. 1983).
A promising technique, applicable at all levels of theory and experiment, for examining the effects of bonding on the isotropic Compton profiles is to form the bond difference profile by subtrcting from the molecular profile the sum of the profiles of the moieties that are considered to come together to form the bond under consideration. Isotropic Compton profiles J(q) and their parent spherically averaged one-electron momentum densities $\Pi(p)$ for the alkaline-earth oxides are examined in order to see how they reflect similar but different bonding situations in this homologous series. (14 refs.)

117769 Lower-bound energy functionals and their application to diatomic systems. A.Berk (Dept. of Chem., Univ. of North Carolina, Chapel Hill, NC, USA).
Phys. Rev. A (USA), vol.28, no.4, p.1908-23 (Oct. 1983).
A systematic method for determining lower-bound energy functionals within both the density-functional and orbital frameworks is presented. Lower-bound calculations are carried out on the Thomas-Fermi-Dirac-1/5 von Weizsacker (TFD1/5W) diatomic nitrogen molecule and the Hartree-Fock (HF) diatomic hydrogen molecule. In the TFD1/5W model, binding is found but not as much as previously thought to exist. Furthermore, an anomaly in the behavior of the energy at short internuclear distances (~1 bohr) is discovered through comparisons with HF data. In the Hartree-Fock theory, a strict lower bound on the H_2 potential-energy curve is obtained without performing any two-electron integrals. A dissociation energy results, which is 6% more than the exact HF value. (24 refs.)

117770 Pseudopotential local-spin-density calculations for Si_2. J.E.Northrup, M.T.Yin, M.L.Cohen (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Phys. Rev. A (USA), vol.28, no.4, p.1945-50 (Oct. 1983).
Pseudopotential local-spin-density calculations of the bond lengths, vibrational energies, and dissociation energies for the $^3\Sigma_g{}^-$, $^3\Pi_u$, and two $^1\Sigma_g{}^+$ states of the silicon dimer have been performed. The bond lengths are within 1% and the vibrational frequencies are within 5% of experimental values. The dissociation energy of the ground state is larger than experiment by ~1.25 eV. These results are near the limits of accuracy of the local-spin-density approximation. (26 refs.)

117771 Approximate solution of the strongly magnetized hydrogenic problem with the use of an asymptotic property. W.Rosner, H.Herold, H.Ruder, G.Wunner (Inst. fur Theoretische Astrophys., Univ. Tubingen, Tubingen, Germany).
Phys. Rev. A (USA), vol.28, no.4, p.2071-7 (Oct. 1983).
It is shown that the effective potentials of the adiabatic approximation, which depend on the magnetic field parameter $\beta=B/B_0$ ($B_0\simeq4.70\times10^5$ T) and the quantum number $s=-\mathrm{m}\geq0$ of the z component of the angular momentum, asymptotically (i.e. for large s) can be traced back to one single potential function which solely depends on the ratio $p=\beta/(s+1/2)$. For this asymptotic potential, numerical solutions of the Schrodinger equation are determined in the range $10^{-3}\leq p\leq10^{+3}$ for $0\leq v\leq20$ (v being the number of nodes of the longitudinal wave function). Exploiting the concept of quantum excesses, the asymptotic energies are extrapolated to $v>20$. It is found that the asymptotic energies provide the energy values of the real physical problem of hydrogenic atoms in magnetic fields $\beta\gtrsim1$ within an accuracy of $\lesssim1\%$ for every $s\geq3$ and arbitrary v, with the accuracy improving rapidly, as β, s, or v is increased. Thus the authors' results ideally complement those for $s<3$ for which accurate results have been tabulated in the literature. (19 refs.)

117772 Ab initio study of the vibrational spectrum and geometry of oxetane. I. Interpretation of the vibrational spectra. G.Banhegyi (Res. Inst. for Plastics, Budapest, Hungary), P.Pulay, G.Fogarasi.
Spectrochim. Acta Part A (GB), vol.39A, no.9, p.761-9 (1983).
As a first step toward the understanding of the role the zero-point energy of the fast vibrations plays in the effective puckering potential of oxetane, the authors have evaluated the force field of this molecule at three different values of the puckering angle by ab initio SCF calculations, using the 4-21 basis set. The force constants of the planar configuration, scaled by six empirical parameters, were used to establish the assignment of the high-frequency fundamental vibrations of oxetane and four of its deutero derivatives. The authors' results support most of the empirical assignments made by Kydd, Wieser and Kiefer (1983), but in each isotopomer one of the B_1 (out-of-plane) fundamentals must be assigned to a much higher frequency than they assumed. Except for a few cases where deviations up to 40 cm^{-1} occur, as a probable consequence of the inadequate description of ring strain and large anharmonicity connected with puckering, the theoretical spectrum reproduces most experimental frequencies to within 20 cm^{-1}. (35 refs.)

117773 Approximation electric potentials. G.G.Hall (Dept. of Math., Univ. of Nottingham, Nottingham, England).
Theor. Chim. Acta (Germany), vol.63, no.4, p.357-64 (1983).
It is shown that the elecrostatic energy functional is the only one available for fitting a given potential using approximate electric potentials arising from point charges. The significance of this fitting is examined in terms of splines. To illustrate the method the electron densities of atoms are modelled using point charges at the vertices of tetrahedra and of cubes. (4 refs.)

117774 g-factors for a spherical-top molecule. I.R.Akhmedov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.16-21 (Aug. 1983). In Russian.
Calculation of *g*-factors for a spherical-top molecule is considered. The energy for a spherical-top molecule is obtained in constant magnetic field. (9 refs.)

Relativistic calculation of the natural width of energy levels for multicharged one-electron ions .... See Entry 117807

Finite-field many-body perturbation theory of the Fermi contact nuclear-spin coupling .... See Entry 117895

The He (I) and He (II) photoelectron spectra of BIS (2,4,6-tri-*t*-butylphenyl)-diphosphene .... See Entry 117923

Proton affinities of GeH_4 and SiH_4. III. Calculations of proton affinity of GeH_4 in terms of a large basis set including polarization functions .... See Entry 118011

Semi-empirical diamagnetic susceptibilities of cyclic β-ketoacetals .... See Entry 118013

Geometric and electronic structural characterization of (3-cyano-4,5-dimethyl pyrrol-2-yl) oxamic acid ethyl ester using X-ray diffraction and ab initio quantum mechanics .... See Entry 118987

Ground state energy and structure of physisorbed monolayers of linear molecules .... See Entry 119337

The energy V_0 of the quasi-free electron in gaseous, liquid and solid methane . ... See Entry 119386

31.20D Complete ab initio calculations (exact or nearly exact calculations on small species)

An initio calculation of the Heisenberg exchange interaction between O_2 molecules .... See Entry 117954

31.20E Ab initio LCAO and GO SCF calculations

117775 Ground state structures of thiocyanogen and its cation. S.P.So (Dept. of Chem., Chinese Univ. of Hong Kong, Hong Kong).
THEOCHEM (Netherlands), vol.13, no.1-2, p.241-6 (Sept. 1983).
The ground state structures of thiocyanogen and its cation have been studied by ab initio calculations. Results show that they both have bent SCN linkages. Further, first ionization changes the H_2O_2-like structure of the parent molecule to a planar trans one. (35 refs.)

117776 Hydrogen-bond energies of FHF^- and $HOHF^-$. Ab initio studies of strong hydrogen bonds involving fluoride, using improved fluoride energies. J.Emsley, R.J.Parker (Dept. of Chem., King's Coll., London, England), R.E.Overill.
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1347-53 (Sept. 1983).
Using a large flexible Gaussian basis set the calculated hydrogen-bond energy of FHF^- is 169 kJ mol^{-1}, which agrees well with a recent gas-phase ion cyclotron resonance determination of 163 kJ mol^{-1}. Reoptimization of the 4-31G and double-zeta basis-set scale factors for F results in substantially lower energies for the fluoride ion and also leads to much improved hydrogen-bond energies for FHF^-. A similar improvement is found for $HOHF^-$. The hydrogen-bond energy of the CH_3OHF^- complex is computed for the first time and shows good agreement with experiment. Other heteronuclear systems involving hydrogen bonding to F^- have been recalculated using this approach. (37 refs.)

31.20G Other accurate, or nearly ab initio calculations (DIM method, SAMO method, etc.)

Configuration interaction with $X\alpha$ orbitals. A CI and RSPT study of the ground and ionized states of the Be atom .... See Entry 117794

31.20N Semi-empirical NDO calculations (CNDO, INDO, MINDO, PCILO methods, etc.)

117777 Compliant fields for water, ammonia, and methane. A.S.N.Murthy, S.Ranganathan (Dept. of Chem., Indian Inst. of Technol., New Delhi, India).
THEOCHEM (Netherlands), vol.13, no.1-2, p.1-8 (Sept. 1983).
An approximate and economical method has been developed to derive the quadratic potential functions using a combination of the CNDO/Force method and the compliance constant approach. This new approach has been used to determine the force constants and harmonic vibrational frequencies for the normal and isotopic species of water, ammonia and methane. The results are expressed in terms of internal valence compliance constants. (8 refs.)

117778 A CNDO/S-CI investigation of planar and orthogonal anisole. H.Konschin, M.Lindblad (Dept. of Chem., Univ. of Helsinki, Helsinki, Finland).
THEOCHEM (Netherlands), vol.13, no.1-2, p.37-47 (Sept. 1983).
CNDO/S-CI calculations for planar and orthogonal anisole (methoxybenzene) have been done with single excitation configuration interaction. Both singlet and triplet transition energies are reported for the two currently proposed β^0(O) parameterizations. The influence of internal rotation upon the features of the electronic spectra is discussed. Excited state charge distributions for singlet and triplet states are presented, and some photochemically interesting implications are discussed. Calculated ionization potentials are compared with available experimental data. (39 refs.)

117779 Theoretical force field and vibrational spectrum of maleimide by the CNDO/2 force method. L.Harsanyi (Res. Lab. for Inorganic Chem., Hungarian Acad. of Sci., Budapest, Hungary), P.Csaszar, G.Fogarasi, G.Horvath, I.Szilagyi.
THEOCHEM (Netherlands), vol.13, no.1-2, p.79-89 (Sept. 1983).
In-plane and out-of-plane vibrations of malemide have been studied by the CNDO/2 force method. To account for systematic errors, the direct theoretical force field was scaled by empirical factors optimized on the basis of experimental frequencies. The calculations suggest some new assignments in the vibrational frequencies. (3 refs.)

117780 MINDO/3 study of the hydrogen insertions of cyclopropenylidene and cyclopropylidene. H.T.Tsang, W.K.Li (Dept. of Chem., Chinese Univ. of Hong Kong, Hong Kong).
THEOCHEM (Netherlands), vol.13, no.1-2, p.95-104 (Sept. 1983).
The least-motion and non-least motion paths of the hydrogen insertions of cyclopropenylidene (I) and cyclopropylidene (II) have been studied with the MINDO/3 method. It is found that, for both reactions, the non-least-motion path is preferred. The concerted non-least-motion paths of both reactions consist of two distinguishable steps, an electrophilic phase followed by a nucleophilic phase. The former is characterized by the formation of a three-centre bond; electron flows from the σ orbital of H_2 into the p_π orbital of the carbenic centre. In the nucleophilic phase, the H-H bond is broken as the carbene lone pair attacks the σ^* orbital of H_2. Due to the higher p_π population at the carbenic centre of (I), the transition state for the reaction of H_2+(I) occurs much later than that for H_2+(II). Also, this brings about the larger activation energy for the former reaction. (9 refs.)

117781 Molecular fragmentations. XIV. Structures and energies of the mass spectral fragments derived from the methylphosphines. J.R.Bews, C.Glidewell (Chem. Dept., Univ. of St. Andrews, St. Andrews, Fife, Scotland).
THEOCHEM (Netherlands), vol.13, no.1-2, p.105-14 (Sept. 1983).
For pt.XIII see ibid., vol.94, p.305 (1983). Molecular structures and energies have been calculated, using the MNDO method with UHF wavefunctions for open shell species, for the molecular and all the fragment ions, and their associated neutral fragments, occurring in the mass spectra of methylphosphine, dimethylphosphine and trimethylphosphine. (11 refs.)

117782 Computer-assisted studies of hypolipidemic drugs. C.Tosi, L.Barino (Istituto Richerche 'Guido Donegani', Novara, Italy), P.Melloni, F.Salvetti.
THEOCHEM (Netherlands), vol.13, no.1-2, p.135-45 (Sept. 1983).
Studies of the molecular structure of clofibrate and the ethyl ester of 6-H, 6-methyl-dibenzo [b,d] pyran, 6-carboxylic acid are reported. Stable conformers have been determined by the quantum mechanical semirigorous method PCILO, some results being backed by the all-electron method IBMOL. The best steric fit between these conformers is evaluated using the program FMFIT. It is found that clofibrate has limited conformational freedom. The introduction of a phenyl ring in place of one of the methyl groups of clofibrate and the linkage of the two phenyl rings in the dibenzo [d,b] pyran structure imparts a highly rigid structure to the molecule. Matching the ethyl ester and the aryloxy moieties of both molecules simultaneously would force clofibrate into an impossible formation: if the constraint of superimposition of the phenyl rings is limited to the baricentres, a good fit can be achieved between low-energy conformers. The different pharmacological activities might be related to the different orientations of the rings. (15 refs.)

117783 Calculation of solvent and internal rotation effects on $^3J_{FH}$ and $^3J_{HH}$ spin-spin coupling constants in 1,2-difluoroethane. S.Watanabe (Minato High School of Technol., Tokyo, Japan), I.Ando.
THEOCHEM (Netherlands), vol.13, no.1-2, p.155-61 (Sept. 1983).
The effects of rotation around the C-C bond and solvent dielectric constants (ε) on $^3J_{FH}$and $^3J_{HH}$ in 1,2-difluoroethane(1,2-DFE) have been studied. $^3J_{FH}$ and $^3J_{HH}$ in 1,2-DFE have been calculated by FPT-INDO-Solvaton method, and are compared with experimental values. The results indicate that an increase in $^3J_{FH}$in 1,2-DFE with increasing ε is not due to a change of conformation caused by increasing ε, but is caused by variation in the electronic structure of 1,2-DFE as a solute. Also, an increase of ε leads to a decrease of *p* character in the F...H bond (an increase of *s* character), an increase in the *p* character of the F atom, and an increase of the difference (Δq_{FH}) in charge density between F...H atoms. (7 refs.)

117784 Some INDO parameterised MO calculations of cobalt nuclear shielding in some diamagnetic hexacoordinate cobalt(III) complexes. B.N.Lamphun, G.A.Webb (Dept. of Chem., Univ. of Surrey, Guildford, England).
THEOCHEM (Netherlands), vol.13, no.1-2, p.191-6 (Sept. 1983).
Some ^{59}Co nuclear shieldings are calculated by means of Pople's model in conjunction with INDO parameters. Reasonable agreement between calculated and observed ^{59}Co chemical shifts, relative to $[Co(CN)_6]^{3-}$, is reported. The interpretation of the chemical shift differences in terms of variations in $\langle r^{-3}\rangle_{3d}$ and ΔE is examined. (27 refs.)

117785 Theoretical studies on conformational isomerism of bifurans and bipyrroles. E.Orti, F.Tomas, J.Sanchez-Marin (Dept. de Quimica-Fisica, Univ. de Valencia, Valencia, Spain).
THEOCHEM (Netherlands), vol.13, no.1-2, p.197-206 (Sept. 1983).
An INDO-SCF-LCAO-MO study has been performed for all isomers of bifurans and bipyrroles. The conformational problem for these molecules has been studied by performing a complete geometry optimization for each conformation. The trans conformers are the most stable for all isomers except for 2,3′-bifuran where the greater stability corresponds to the cis conformer. The torsional barrier about the interannular bond is also estimated for all isomers, together with total geometry optimization. The barriers are of relative significance but enable attainment of equilibria between both conformers. The particular case of 1,1′-bipyrrole, where an angular conformation presents the greater stability as a compromise between the contrary effects of nonbonded interactions and interannular conjugation, is discussed. The importance of performing geometry optimization on conformational problems is established. (31 refs.)

117786 A comparison of the molecular orbital (ab initio, CNDO and EHT) methods applied to the conformational study of thiocarbonohydrazide in its basic and diprotonated forms. S.Manogaran, D.N.Sathyanarayana (Dept. of Inorganic & Phys. Chem., Indian Inst. of Sci., Bangalore, India).
THEOCHEM (Netherlands), vol.13, no.1-2, p.215-20 (Sept. 1983).
Conformational preferences of thiocarbonohydrazide ($H_2NNHCSNHNH_2$) in its basic and *N,N*′-diprotonated forms are examined by calculating the barrier to internal rotation around the C-N bonds, using the theoretical LCAO-MO (ab initio and semiempirical CNDO and EHT) methods. The calculated and experimental results are compared with each other and also with values for *N,N*′-dimethylthiourea which is isoelectronic with thiocarbonohydrazide. The suitability of these methods for studying rotational isomerism seems suspect when lone pair interactions are present. (26 refs.)

117787 The use of transformation matrices to follow the change in electronic structure of some simple organic molecules upon ionization. G.Frenking (Inst. fur Organische Chem., Tech. Univ. Berlin, Berlin, Germany).
THEOCHEM (Netherlands), vol.13, no.1-2, p.233-9 (Sept. 1983).
MNDO calculations have been performed for the molecules CH_3X (X=H, F, OH, NH_2) and C_2H_n (n=2,4,6) and for the corresponding radical cations. Transformation matrices are calculated between the MO's of the neutral and charged species for vertical and adiabatic ionization. These matrices are then

used to interpret the associated changes in the geometrical and electronic structures. (22 refs.)

117788 Derivation of theoretical formulas for resonance integrals from Heisenberg equation of motion. II. Inclusion of Rydbern and/or inner atomic orbitals in the formalism of NDO-methods. J.Lipinski (Inst. of Organic & Phys. Chem., Tech. Univ. of Wroclaw, Wroclaw, Poland), J.Leszczynski.
Theor. Chim. Acta (Germany), vol.63, no.4, p.305-12 (1983).
On the basis of the Heisenberg equation of motion and Linderberg-Seamans approximations useful formulas for β-resonance integrals in the NDO-like semiempirical methods have been derived. The case of *s,p*-electron elements has been investigated. The possibility of inclusion of Rydberg and/or inner orbitals in the basis set of the valence orbitals has been taken into consideration. The results of the test INDOL/R method calculations of vertical transition energies for H_2 and H_2O molecules has been presented. (28 refs.)

Non-Koopmans contributions to the photoelectron spectra of *p*-quinodimethane, 3,7-dimethyl-*p*-quinodimethane and tetracyano-*p*-quinodimethane: a limited CI description .... See Entry 117921

Breakdown in the Koopmans' theorem interpretation of the outer valence-level photoemission spectra of selected organic molecules .... See Entry 117922

The low-lying cationic hole-states of η^3-allyl tetracarbonyl complexes of Mn and Re—photoelectron spectra and Green's function calculations .... See Entry 117927

31.20P Other semi-empirical calculations (Hückel, generalized Hückel, PPP methods, etc.)

A comparison of the molecular orbital (ab initio, CNDO and EHT) methods applied to the conformational study of thiocarbonohydrazide in its basic and diprotonated forms .... See Entry 117786

Influence of electron correlation on the spectra of streptopolymethines .... See Entry 117797

31.20R Valence bond calculations (ab initio or not)

117789 Calculation of the hydrogen molecule by means of a parametrization obtained from the hydrogen ion-molecule. O.Stradella, G.A.Arteca, E.A.Castro, F.M.Fernandez (Seccion Quimica Teorica, INIFTA, La Plata, Argentina).
J. Phys. Lett. (France), vol.44, no.18, p.L741-53 (15 Sept. 1983).
The electronic energy function of the hydrogen molecule is calculated on the basis of the two simplest and most typical wave functions (MO-LCAO and VB) by introducing a reduction factor for the interelectronic repulsion and other functional parameters modifying the expectation values of both kinetic and potential energies. Such factors are associated to the CI contribution and some of them are calculated from the hydrogen ion-molecule. The comparison with the exact results shows a satisfactory agreement in binding energy, bond length and energy minimum values for the ground state. Some possible extensions of the method are discussed. (15 refs.)

31.20T Electron correlation and CI calculations

117790 Theoretical investigation of the interaction of propene with a sodium ion. R.Lochmann, T.Weller (Sektion Phys., Karl-Marx-Univ., Leipzig, Germany).
THEOCHEM (Netherlands), vol.13, no.1-2, p.91-4 (Sept. 1983).
An investigation of the interaction of propene with a sodium ion has been carried out by ab initio STO-3G, PCILO, and molecular electrostatic potential using PCILO wave function methods. In contrast to the results of 2-methylpropene (isobutene) ab initio and PCILO agree qualitatively in revealing the stable arrangement of the sodium ion in the area above the final carbon of the double bond to be due to a dominating charge transfer interaction. The electrostatically favoured arrangement of the sodium ion in the region in front of this carbon atom as predicted by the molecular electrostatic potential method, plays a less essential role than for 2-methylpropene. (10 refs.)

117791 Electron affinity of para-benzoquinone by ab initio ΔSCF calculations and semiempirical estimation of electron correlation energy. S.Millefiori, A.Millefiori (Univ. di Catania, Catania, Italy).
THEOCHEM (Netherlands), vol.13, no.1-2, p.131-4 (Sept. 1983).
The electron affinity of para-benzoquinone was computed by ab initio STO-3G and 4-31G ΔSCF calculations and by estimating the electron correlation energy by the semiempirical method of Sinanoglu and co-workers (1962-77). The electron-correlation energy associated with the formation of the mononegative anion is greater than the relaxation energy and amounts to 1.4 eV. The best present estimate of the electron affinity of para-benzoquinone is 2.20 eV, in fair agreement with experimental findings. The negative electron affinity (shape resonance) of benzene was also fairly well reproduced as −1.32 eV. The electron-correlation energy favours the formal disproportionation reaction in the gas phase $2PBQ^{1-} \rightarrow PBQ + PBQ^{2-}$ by 0.45 eV. (19 refs.)

117792 A non-van der Waals minimum of the $He(^1S)+H_2(B^1\Sigma_u^+)$ excited surface. S.C.Farantos, G.Theodorakopoulos, C.A.Nicolaides (Theoretical & Phys. Chem. Inst., Nat. Hellenic Res. Foundation, Athens, Greece).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.263-7 (9 Sept. 1983).
The authors carried out MRD CI calculations for the first excited state of HeH_2 ($^1A'$) at geometries which have He (^1S) approaching the center of mass of H_2 ($B^1\Sigma_u^+$) at 45°. The calculated energies yield a barrier of 0.24 eV and a minimum of 1.5 eV. This minimum occurs near an avoided crossing with the ground-energy surface which is not found for collinear or perpendicular geometries. These results suggest an explanation for the electronic quenching of $HD(B^1\Sigma_u^+)$ in the presence of He observed by Moore and co-workers. (16 refs.)

117793 Relativistic molecular structure calculations including CI for several low lying states of SnO. K.Balasubramanian, K.S.Pitzer (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.273-6 (9 Sept. 1983).
Relativistic quantum calculations including configuration interaction and spin-orbit interaction are described for seven low-lying Λ-S states of SnO and the corresponding ω-ω states with spin-orbit interaction. Spectroscopic properties of these states are computed and compared with experimental results. Properties are predicted for several low-lying electronic states that have not yet been observed experimentally. (9 refs.)

117794 Configuration interaction with Xα orbitals. A CI and RSPT study of the ground and ionized states of the Be atom. G.de Alti, P.Decleva, A.Lisini (Istituto di Chimica, Univ. di Trieste, Trieste, Italy).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.371-4 (16 Sept. 1983).
Configuration-interaction calculations are carried out for the ground and ionized states of the Be atom with various bases of numerical Xα orbitals. These bases prove to be moderately effective for correlating the outer shell, while no correlation involving the inner electrons is achieved. This deficiency is attributed to the spatial nature of the virtual Xα orbitals. (18 refs.)

117795 The correlated electron density of alkali atoms: pseudopotential and density-functional results. A.Savin, M.Dolg, H.Stoll, H.Preuss (Inst. fur Theoretische Chem., Univ. Stuttgart, Stuttgart, Germany), J.Flesch.
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.455-60 (23 Sept. 1983).
Correlation contributions to the valence-electron densities of the Na and K atoms are evaluated by means of pseudopotential and density-functional methods. The results are compared to ab initio values, and reference is made to previous calculations for Li. (20 refs.)

117796 Conformational energetics in hydrogen-bonded dimers. The unobserved CO-HF complex. M.A.Benzel, C.E.Dykstra (School of Chem., Univ. of Illinois, IL, USA).
Chem. Phys. (Netherlands), vol.80, no.3, p.273-8 (15 Oct. 1983).
Ab initio electronic-structure calculations with large basis sets and extensive treatment of electron correlation have been carried out for the CO-HF complex. The potential surface exhibits a local minimum for linear Co-HF that is over 400 cm^{-1} above the absolute minimum that corresponds to the OC-HF structure. The main reason for the difference in the stabilities of the two conformers is the difference in their electron-correlation energies. The interconversion of CO-HF to OC-HF follows a minimum-energy path that takes the complex through a structure where the fluorine end of HF points into the middle regions of CO. (47 refs.)

117797 Influence of electron correlation on the spectra of streptopolymethines. F.Dietz (Section Chem., Univ. Leipzig, Leipzig, Germany), J.Fabian, G.Olbrich, N.Tyutyulkov, I.Kanev.
Izv. Khim. Bulg. Akad. Nauk. (Bulgaria), vol.15, no.4, p.519-24 (1982). [received: Sept. 1983]
Calculations on odd-numbers polyene ions and corresponding α, ω—substituted analogues in PPP approximation with CI including doubling excited configurations demonstrate the significant influence on the calculated spectra by taking into account the effect of electron correlation. (23 refs.)

117798 Hydrogen bonding in excited states of pyridine and pyrazine. C.V.Rama Rao, C.Jacob, A.K.Chandra (Dept. of Inorganic & Phys. Chem., Indian Inst. of Sci., Bangalore, India).
Indian J. Chem. A, vol.22A, no.3, p.183-5 (March 1983). [received: Oct. 1983]
Hydrogen bonding in the excited n-π^* and π-π^* states of pyridine and pyrazine has been examined by calculating the electric field at different points in space from the CNDO charges. Results reveal that the hydrogen bond which is formed in the ground state is broken upon excitation to the n-π^* state in pyridine while a weak hydrogen bonding is possible in the n-π^* state of pyrazine. (13 refs.)

117799 Theoretical equilibrium geometry, vibrational frequencies and the first electronic transition energy of HCC. G.Fogarasi, J.E.Boggs (Dept. of Chem., Univ. of Texas, Austin, TX, USA), P.Pulay.
Mol. Phys. (GB), vol.50, no.1, p.139-51 (Sept. 1983).
Ab initio calculations with the 6-311 G** basis set and all single and double excitations in the CI treatment have been carried out to determine the structure of the HCC radical. The theoretical geometry of R(CC)=1.209, r(CH)=1.067 Å (or 1.205 and 1.063, respectively, if corrected for residual errors) is in excellent accordance with the experimental rotational constant. The calculated harmonic vibrational frequencies are $\nu_1 \simeq 3450$, $\nu_2 \simeq 540$ and $\nu_3 \simeq 2040$ cm^{-1}. An extremely low energy around 2000 cm^{-1} is obtained for the first electronic transition $A^2\Pi \leftarrow X^2\Sigma$. Results for the excited state are also given. The theoretical vibrational frequencies, with all possible errors taken into account, are inconsistent with the accepted interpretations of the few experimental results. It is shown, however, that a complete reinterpretation of the spectroscopic observations is possible, by which the present calculations fit with the recent gas phase infrared laser spectroscopic data but remain in definite contradiction with the infrared matrix results. (20 refs.)

117800 Configuration mixing within the 2*s*-2*p* shell. C.Wulfman (Dept. of Phys., Univ. of Canterbury, Christchurch, New Zealand).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1159-62 (26 Sept. 1983).
The Coulombic Hamiltonian of atoms approximately commutes with an N-electron operator which is a sum of O(4) Casimir operators. This accurately fixes configuration mixing within the entire 2*s*-2*p* shell. Several aspects of the stability of the results are discussed. (8 refs.)

117801 Collective and independent-particle motion in doubly excited two-electron atoms. G.S.Ezra, R.S.Berry (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
Phys. Rev. A (USA), vol.28, no.4, p.1974-88 (Oct. 1983).
Configuration-interaction wave functions are calculated for all intrashell doubly excited states of the $N=2$ shell for He and isoelectronic ions Li^+, Be^{2+}, and Ne^{8+} with the use of a basis of Sturmian functions. The density function $\rho(r_1,\theta_{12}|r_2=\alpha)$, which is the conditional probability that one electron will be found at distance r_1 from the nucleus with interelectronic angle θ_{12} given that the other electron is at distance α from the nucleus, is computed for each of the states and for various values of α. Density plots for the $^1S^e$ states of He are compared with those from Hylleraas-Kinoshita wave functions to assess the quality of the Sturmian basis. Sequences of plots are then examined to investigate the possibility of collective motion in doubly excited states. For He the form of the densities $\rho(r_1,\theta_{12}|\alpha)$ is in qualitative accord with the molecular model proposed by Kellman and Herrick (1978) in that the collective rotational and bending vibrational states are readily identifiable. With increasing nuclear charge a transition occurs to less collective behavior, corresponding to superpositions of hydrogenic configurations associated solely with the $N=2$ shell. Some states, e.g. $^1D^e$, correspond to single independent-particle configurations. Electron density distributions are also presented for the lowest S and P states of the He $n_1=2$, $n_2=3$ intershell manifold with a view to extension of the molecular interpretation to this case. Results are compared with those of calculations of the quantum states of model problems such as particles on concentric spheres. (49 refs.)

117802 Electronic configuration mixing and isotope shifts in singly ionized dysprosium. S.A.Ahmad, A.Venugopalan, G.D.Saksena (Spectroscopy Div., Bhabha Atomic Res. Centre, Bombay, India).
Spectrochim. Acta Part B (GB), vol.38B, no.8, p.1115-24 (1983).
The isotope shifts in 62 spectral lines of the singly ionised dysprosium in the region 3860-4665 Å have been studied using a photoelectric recording Fabry-Perot spectrometer and enriched isotopes ^{160}Dy and ^{164}Dy excited in liquid-nitrogen cooled hollow cathodes. On the basis of the present data, the

reported mixing of the configurations $4f^9 4d6s$, $4f^9 5d^2$ and $4f^{10} 6p$ have been confirmed for 27 odd levels by means of a 'sharing rule'. Isotope shifts in transitions from the high even levels of $4f^9 5d6p$ and $4f^9 6s6p$ to low odd levels of $4f^9 5d6s$ and $4f^9 6s^2$ configurations are reported for the first time. Electronic configurations have been suggested for nine unassigned odd levels. (15 refs.)

117803 Relativistic and correlation corrections to electron affinities of alkali and halogen atoms. W.Nowak, J.Karwowski, M.Klobukowski (Inst. Fizyki, Uniwersytet Mikolaja Kopernika, Torun, Poland).
Theor. Chim. Acta (Germany), vol.63, no.4, p.313-16 (1983).
Electron affinities (EAs) of alkali and halogen atoms have been calculated using Hartree-Fock and Dirac-Hartree-Fock methods. Comparing the results with the experimental values, relativistic and correlation corrections to EAs have been estimated. In the case of alkali atoms correlation correction constitute 110%-120% of the experimental EA values. In the case of halogens the corresponding numbers are 30%-60%. Relativistic effects are negligibly small for alkali atoms but significant for halogens (40% of the experimental value for At). (14 refs.)

117804 Triplet-singlet interaction in the $1s\ 2s^3S_1$ hyperfine splitting of He-like Li^+. J.Kowalski, R.Neumann, S.Noehte, H.Suhr (Phys. Inst., Univ. Heidelberg, Heidelberg, Germany), G.zu Putlitz, R.Herman.
Z. Phys. A (Germany), vol.313, no.3, p.147-50 (1983).
The hyperfine structure (hfs) interaction between the metastable 2^3S_1 and 2^1S_0 states in $^{6,7}Li^+$ causes very small equal and opposite energy level shifts, δ, in the two levels having the same total angular momentum quantum number $F=I$. This amounts to 12 ppm with respect to the total hfs splitting of 30 GHz for the $^7Li^+$ 2^3S_1 state and has been measured for the first time directly for the case of a core-free electronic system by combined laser-microwave spectroscopy. A new calculation of δ with accurate integral-transform 2^1S_0 and 2^3S_1 wave functions is reported. Configuration interactions and electron exchange and correlation effects, which differ for parallel ($^3S_1$) and antiparallel ($^1S_0$) spins, are treated in detail in order to obtain very good agreement between measured and theoretical values for this tiny perturbation. A complete understanding of δ is indispensible for extracting fundamental constants from two-electron spectroscopic data. (20 refs.)

Finite perturbation MCSCF and CI calculations of nuclear spin-spin coupling constants for some molecules with multiple bonds .... See Entry 117763

A CNDO/S-CI investigation of planar and orthogonal anisole ....
.... See Entry 117778

Calculation of the hydrogen molecule by means of a parametrization obtained from the hydrogen ion-molecule .... See Entry 117789

Non-Koopmans contributions to the photoelectron spectra of *p*-quinodimethane, 3,7-dimethyl-*p*-quinodimethane and tetracyano-*p*-quinodimethane: a limited CI description .... See Entry 117921

Breakdown in the Koopmans' theorem interpretation of the outer valence-level photoemission spectra of selected organic molecules .... See Entry 117922

A theoretical analysis of the relative roles of ground and excited states in the bond rupture and hydrogen migration pathways in ethyl and vinyl radicals ....
.... See Entry 120593

31.30 CORRECTIONS TO ELECTRONIC STRUCTURE

117805 Magnetic susceptibility of 1,1′,2,2′-tetramethylcobaltocene and 1,1′-diethylcobaltocene: evidence for the dynamic Jahn-Teller effect. E.Konig, V.P.Desai (Inst. fur Phys. und Theoretische Chem., Univ. Erlangen-Nurnberg, Erlangen, Germany), B.Kanellakopulos, F.H.Kohler.
Chem. Phys. (Netherlands), vol.80, no.3, p.263-72 (15 Oct. 1983).
The magnetic susceptibility of 1,1′,2,2′-tetramethylcobaltocene, $Co[C_5H_3(CH_3)_2]_2$, and 1,1′-deithylcobaltocene, $Co(C_5H_4C_2H_5)_2$, has been studied between 0.99 and 296K. The data are well reproduced by a calculation of the dynamic Jahn-Teller effect for the $^2E_{1g}(a^2{}_{1g}e_{2g}{}^4e_{1g})$ ground state of D_{5d} symmetry. A suitable set of parameter values is given by $\zeta=100\ cm^{-1}$, $\delta=150\ cm^{-1}$, $k_{JT}=0.40$, $\kappa=0.70$. The magnetism of cobaltocene, $Co(C_5H_5)_2$, may be described by parameter values of comparable magnitude. The results imply a significantly larger reduction of the spin-orbit coupling parameter ζ due to covalency than of the orbital reduction factor κ. (20 refs.)

117806 Hyperfine structure splittings of the hydrogen atom in a covariant Hamiltonian formalism. T.Fujii, H.Enatsu (Dept. of Phys., Ritsumeikan Univ., Kyoto, Japan).
Mem. Res. Inst. Sci. & Eng. Ritsumeikan Univ. (Japan), no.41, p.11-20 (1982).
On the basis of a covariant Hamiltonian formalism, the nuclear correction to the hyperfine mass levels of the hydrogen atom are calculated. An approximation method in which Dirac spinors reduce to Pauli spinors, is employed. The results are compared with those obtained previously in an approximation method slightly different from the present one. (7 refs.)

117807 Relativistic calculation of the natural width of energy levels for multicharged one-electron ions. T.E.Timofeeva.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.82-4 (Aug. 1983). In Russian.
A general expression suitable for the numerical calculations of the natural width of energy levels for multicharged one-electron ions have been obtained within the framework of the adiabatic S-matrix formalism. The width of the energy level $2p_{1/2}$ has been calculated within the nonrelativistic limit. (4 refs.)

Some INDO parameterised MO calculations of cobalt nuclear shielding in some diamagnetic hexacoordinate cobalt(III) complexes .... See Entry 117784

Relativistic and correlation corrections to electron affinities of alkali and halogen atoms .... See Entry 117803

On the role of the dynamic Jahn-Teller effect in the spectra of matrix-isolated atoms with strong spin-orbit coupling .... See Entry 117817

Theoretical study of shake-up in the core photoelectron spectra of the alkali atoms .... See Entry 117842

Normal coordinate treatment of liquid water and calculation of vapor pressure isotope effects .... See Entry 117860

Trigonal-^{13}C hyperfine coupling in CF_3CCl_2 .... See Entry 117897

New experimental investigations of the density effect on inner-shell excitation and energy loss .... See Entry 117976

31.50 EXCITED STATES

117808 The method of delayed coincidences applied to the measurement of the lifetimes of K^+ ion excited states. M.A.Martin Vicente, J.Campos Gutierrez (Ciudad Univ., Madrid, Spain).
An. Fis. Ser. B (Spain), vol.79, no.2, p.164-70 (May-Aug. 1983). In Spanish. [received: Oct. 1983]
The first experimental values for the lifetime of K^+ levels obtained by delayed coincidence are given. The method of measurement was excitation by low energy electron pulses followed by single photon counting. The measured levels belong to the 3p5 4p configuration. (33 refs.)

117809 Contrasting picosecond photokinetics of Co^{II} and Co^{III} porphyrins verify excited-state predictions. C.D.Tait, D.Holten (Dept. of Chem., Washington Univ., St. Louis, MO, USA), M.Gouterman.
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.268-72 (9 Sept. 1983).
Using picosecond transient absorption techniques, the authors observed different low-lying excited states for several Co^{II} and Co^{III} porphyrins. These differences are interpreted in terms of theoretical calculations that predict the lowest-energy excited states to be $^2(\pi, d)$ in Co^{II} and $^3(d, d)$ in Co^{III}. (23 refs.)

117810 Resonant states of the hydrogen atom in strong magnetic fields. D.W.Noid (Oak Ridge Nat. Labs., Oak Ridge, TN, USA), S.K.Knudson, J.B.Delos.
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.367-70 (16 Sept. 1983).
Resonant states of atomic hydrogen in strong magnetic fields have been computed by semiclassical methods. Eigenvalues are obtained by using an adiabatic separation of variables and standard WKB methods; these are confirmed by semiclassical quantization of numerically quasiperiodic trajectories. Large numbers of resonant states are found at $B=10$ kT for L_z values above 20. (13 refs.)

117811 Recurrent algorithm solution of an infinite series of linear differential equations using a triangular matrix. I.M.Gaisinskii.
Zh. Vychisl. Mat. & Mat. Fiz. (USSR), vol.23, no.4, p.1003-7 (July-Aug. 1983). In Russian. English translation in: *USSR Comput. Math. & Math. Phys. (GB)*
A recurrence algorithm for calculating the coefficients of an infinite system of ordinary linear differential equations with constant coefficients with respect to a base function by a Greens function matrix expansion is constructed for the case when equality of the diagnoal elements of the original triangular matrix system is allowed. An investigation is made of the convergence of the proposed algorithm. As an example a calculation is presented of a system of kinetic equations describing the relaxation of a populated Rydberg state of a hydrogen atom for the dominant spontaneous radiation processes. (6 refs.)
A.G.C.

Critical behavior of a three-dimensional dimer model .... See Entry 117108

An analytic approximation for the energy levels of neutral atoms ....
.... See Entry 117749

Semiclassical self-consistent field calculations of Feshbach resonance energies
.... See Entry 117762

A CNDO/S-CI investigation of planar and orthogonal anisole ....
.... See Entry 117778

A non-van der Waals minimum of the $He(^1S)+H_2(B^1\Sigma_u{}^+)$ excited surface ....
.... See Entry 117792

Hydrogen bonding in excited states of pyridine and pyrazine ....
.... See Entry 117798

Configuration mixing within the 2*s*-2*p* shell .... See Entry 117800

Collective and independent-particle motion in doubly excited two-electron atoms
.... See Entry 117801

Triplet-singlet interaction in the $1s\ 2s^3S_1$ hyperfine splitting of He-like Li^+ ....
.... See Entry 117804

The potential energy curve from the excited state $A^1\Sigma^+$ of KH ....
.... See Entry 117812

Observation of Na I inner shell-excited quartet terms .... See Entry 117823

Stark effect in barium 6*snd* $^1D_2$ Rydberg states; evidence of strong perturbations in the $^1F_3$ series .... See Entry 117831

Tensor hyperpolarizability of the 6*s*19*d* $^1D_2$ barium Rydberg state ....
.... See Entry 117833

Natural radiative lifetimes in the $^2S_{1/2}$ and $^2D_{5/2,3/2}$ sequences of aluminum ....
.... See Entry 117839

Secondary ionisation processes in laser-induced cascade ionisation ....
.... See Entry 117843

Spin relaxation in the phosphorescent triplet state of several pyridyl carbonyl compounds .... See Entry 117900

Picosecond fluorescence relaxation kinetics from all-trans retinal ....
.... See Entry 117906

Determination of the quenching rates of $N_2{}^+(B^2\Sigma_u{}^+, \nu=0,1)$ by N_2 using laser-induced fluorescence .... See Entry 117907

Generation of $^1O_2$ from O_2 quenching of the lowest excited singlet and triplet states of 9,10-diphenylanthracene .... See Entry 117908

Comments on 'Generation of $^1O_2$ and the mechanism of internal conversion in 9,10-diphenylanthracene' .... See Entry 117909

Generation of $^1O_2$ by 9,10-diphenylanthracene .... See Entry 117910

Determination of the dipole moment of thioformaldehyde in the $\tilde{a}\ ^3A_2$ excited state by laser phosphoresence excitation spectroscopy .... See Entry 117915

Radiative lifetime and quenching of $SO(b^1\Sigma^+, \nu'=0)$ .... See Entry 117929

Photofragmentation of HI in the first continuum .... See Entry 117941

The quenching of anthracene triplets by ground-state anthracene ....
.... See Entry 117958

Observation of self-induced Rabi oscillations in two-level atoms excited inside a resonant cavity: the ringing regime of superradiance .... See Entry 118108

Measurement of total decay rates of excited states in a deuterium plasma by laser-resonance fluorescence .... See Entry 118756

Photochemistry and sensitized evolution of hydrogen from water using water-soluble cationic porphyrins. Tetrakis(trimethylaminophenyl)porphyrinatozinc and its free base .... See Entry 120657

31.70 EFFECTS OF MOLECULAR INTERACTIONS ON ELECTRONIC STRUCTURE

(see also 34. Atomic and molecular collision processes and interactions)

31.70D Environmental and solvent effects

Calculation of solvent and internal rotation effects on $^3J_{FH}$ and $^3J_{HH}$ spin-spin coupling constants in 1,2-difluoroethane .... See Entry 117783

Spectroscopic study of 2-amino-4-cyano-3-phenyl-5-(p-chlorophenyl)-furane in various solvents .... See Entry 117861

Abnormal behaviour in the evolution of the UV spectra of para-fluorophenylacetic acid as a function of pH .... See Entry 117887

On the nature of the fluorescent state of methylated indole derivatives .... See Entry 117916

Nonradiative relaxation of singlet oxygen in solution .... See Entry 117917

Analytical molecular surface calculation .... See Entry 117950

31.70F Potential-energy surfaces for collisions

(see also 82.20K in chemical kinetics, 34.20 Intermolecular forces, 34.50L in beam studies)

Vacuum ultraviolet photoelectron spectroscopy of transient species. XVI. The NCO($X^2\Pi$) radical .... See Entry 117926

Dissociation energy of Li_2 molecule .... See Entry 118009

31.70H Time-dependent phenomena: excitation and relaxation processes, and reaction rates

(see also 34. Atomic and molecular collisions)

Determination of the quenching rates of $N_2^+(B^2\Sigma_u^+, v=0,1)$ by N_2 using laser-induced fluorescence .... See Entry 117907

31.70K Molecular solids

An initio calculation of the Heisenberg exchange interaction between O_2 molecules .... See Entry 117954

31.90 OTHER TOPICS IN THE THEORY OF ATOMS AND MOLECULES

(inc. properties other than energy)

117812 The potential energy curve from the excited state $A^1\Sigma^+$ of KH. A.Pardo, J.M.L.Poyato, M.S.Guijarro (Dept. de Quimica-Fisica y Quimica Cuantica, Univ. Autonoma de Madrid, Madrid, Spain).
An. Fis. Ser. A (Spain), vol.79, no.2, p.121-9 (May-Aug. 1983). [received: Oct. 1983]
The authors present the molecular constants revised for the $A^1\Sigma^+$ state of the KH molecule. These constants are used for the determination of the RKR potential energy curve by a new method with numerical integration. Results are in good agreement with the others' authors. (14 refs.)

117813 The hydrogen atom in a magnetic field—symmetries in the low field diamagnetic limit. J.C.Gay, D.Delande (Lab. de Spectroscopie Hertzienne, d'Ecole Normale Superieure, Paris, France).
Comments At. & Mol. Phys. (GB), vol.13, no.6, p.275-97 (1983).
Surprisingly, understanding the magnetism of the atom is still a major problem of contemporary physics. The basic aspects of the paramagnetic interaction responsible for the Zeeman effect have been understood since the work of Lorentz, but not the diamagnetic part of the magnetic interaction, which from Maxwell's equations is as essential as the paramagnetic part. The diamagnetic interaction may be responsible for a complete alteration of atomic properties, changing the Coulomb signature of the spectrum to a Landau one. There have been major advances in this field over the last few years. The authors review those in the low field Coulomb limit which turn out to be major pieces of the puzzle. Classical mechanics and group theoretical methods play an important role. At present they allow a complete understanding of the diamagnetic regime at low fields, although they are yet far from a general solution for the whole problem. (36 refs.)

117814 Effective core potential calculations using frozen orbitals. Applications to transition metals. L.G.M.Pettersson (Inst. of Theoretical Phys., Univ. of Stockholm, Stockholm, Sweden), U.Wahlgren, O.Gropen.
Chem. Phys. (Netherlands), vol.80, no.1-2, p.7-16 (Oct. 1983).
The effective core potential (ECP) method is modified to include frozen orbitals in order to improve the description of the outer core-valence interactions. Applications are made to the Sc, Ni and Pd atoms and several compounds containing these. It is shown that the new ECP resolves the earlier problems concerning the bond distance in $ScO(^2\Sigma^+)$ and the rotational barrier in $[NiH_4]^{2-}$. At the MC and CI levels the $^2\Delta$ and $^2\Pi$ states of NiH are accurately described using the new type of ECP. (27 refs.)

117815 Potential surfaces derived from gradient calculations—new potentials for Li^+/H_2O, Na^+/H_2O and K^+/H_2O. D.G.Bounds, P.J.Bounds (IBM Dept., Poughkeepsie, NY, USA).
Mol. Phys. (GB), vol.50, no.1, p.25-32 (Sept. 1983).
It is shown how simple ion-water potentials may be derived from a small number of calculations of energy derivatives without recourse to multiparameter fitting. The method is tested against athe SCF data for Li^+/H_2O, Na^+/H_2O and K^+/H_2O due to Kistenmacher, Popkie and Clementi (1972, 1973) and also against the more extensive Na^+/H_2O data of Dacre. New four-centre potentials are proposed for Li^+/H_2O, Na^+/H_2O and K^+/H_2O. (17 refs.)

117816 Hyperspherical representations of triatomic energy surfaces. M.Mishra, J.Linderberg (Dept. of Chem., Aarhus Univ., Aarhus, Denmark).
Mol. Phys. (GB), vol.50, no.1, p.91-6 (Sept. 1983).
Examples of triatomic electronic energy surfaces are presented in terms of hyperspherical coordinates using a mapping introduced by Mead (1980). An approximate electronic ground state energy is determined from the Hubbard model for the H_3 system and graphs are prepared for different values of the hyperspherical radius. (16 refs.)

Ab initio study of rotational isomerism in cyclopropanecarboxaldehyde .... See Entry 117754

Approximation electric potentials .... See Entry 117773

Resonant states of the hydrogen atom in strong magnetic fields .... See Entry 117810

Photofragmentation of HI in the first continuum .... See Entry 117941

32.00 ATOMIC SPECTRA AND INTERACTIONS WITH PHOTONS

32.20 ATOMIC SPECTRA GROUPED BY WAVELENGTH RANGES

117817 On the role of the dynamic Jahn-Teller effect in the spectra of matrix-isolated atoms with strong spin-orbit coupling. C.M.Weinert, F.Forstmann (Inst. fur Theoretische Phys., Freie Univ. Berlin, Berlin, Germany), R.Grinter, D.M.Kolb.
Chem. Phys. (Netherlands), vol.80, no.1-2, p.95-111 (Oct. 1983).
The extra splitting of the $S_{1/2}\rightarrow P_{3/2}$ absorption band of matrix-isolated atoms is investigated. The question is raised whether this splitting of the band has its origin in a static axial crystal field or in the coupling of low-symmetry modes of the matrix to the optical transition. Several theoretical and experimental ways of answering this question are discussed. A method of proving the existence of a dynamic Jahn-Teller effect is proposed. It consists of an analysis of the MCD absorption lineshapes up to the third moment. In this proof the authors take advantage of the fact that for strong spin-orbit splitting the parameters appearing in the moments' evaluation are not dependent on the spin-orbit parameter but only on the electron-lattice interaction. For this purpose, a new evaluation of the MCD moments' formulas is performed for strong spin-orbit systems and electron-lattice coupling up to second order in the lattice coordinates. (23 refs.)

117818 Effect of metastable states on the emission lines of OIII, OIV and OV ions. T.Kato (Inst. of Plasma Phys., Nagoya Univ., Nagoya, Japan), K.Masai, J.Mizuno.
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3019-28 (Sept. 1983).
Oxygen ions such as OIII, OIV, OV and OVII have metastable states, for example $2s2p^3(^5S)$, $2s2p^2(^4P)$, $2s2p(^3P)$ and $1s2p(^3P)$. When the electron density is high ($n_e<10^{10}$ cm^{-3}), the population densities of metastable states also become high, and the intensities of emission lines and the populations of ionization states are affected by the collisions with electrons. The authors have studied the density dependence of the line emissions and ionization balance including the populated metastable states. They apply these results to the diagnostics of plasmas.

117819 Electron collisional rate coefficients for low-level transitions in hydrogen. S.A.Drake (Joint Inst. for Lab. Astrophys., Univ. of Colorado, Boulder, CO, USA).
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.15p-19p (Oct. 1983).
Aggarwal (1983) has presented new calculations of the excitation rate coefficients due to electron impact of the $n=1$ to $n'=2$ and $n=1$ to $n'=3$ transitions in atomic hydrogen, and compared them with the semi-empirical rates of Johnson (1972); he has found that the latter calculation can be as much as a factor of 9 too large compared to his new results at temperatures of 5×10^3K. In fact, Aggarwal has miscalculated the Johnson rates, and their actual values are much closer to his new values than he concluded; for the $1\rightarrow2$ transition, the agreement is within 10 per cent for temperatures between 5×10^3K and 3×10^5K, while for the $1\rightarrow3$ transition, the Johnson rate is a factor of 2 too small at low temperatures and 25 per cent too small at the higher temperatures. Thus, it is not possible to make any general statement that the Johnson rates always tend to be overestimates of the correct rates, particularly at low temperatures. (12 refs.)

Investigations on the thermionic diode: the ionisation probability of Rb n^2P_J atoms by noble gas collisions .... See Entry 117957

Line emission from charge transfer with atomic hydrogen at thermal energies .... See Entry 117985

Electron excitation rates among fine structure levels in O III .... See Entry 121523

32.20B Radiofrequency, microwave, and infrared spectra

(inc. magnetic resonance spectra)

117820 Magnetic resonance of cesium atoms in the case of optical pumping by radiation from a single-mode injection laser. L.S.Kornienko, A.L.Kotkin, V.I.Malakhova, V.V.Maiorshin, R.M.Umarkhodzhaev, S.D.Yakubovich (Sci.-Res. Inst. of Nuclear Phys., M.V. Lomonosov State Univ., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.380-2 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.631-3 (March 1983). [received: Oct. 1983]
An investigation was made of the influence of single-mode radiation from an injection laser on the magnetic resonance signal as a function of the laser radiation frequency. It was found that the amplitude, phase, and rate of decay of the free precession signal depended on the tuning of the laser radiation frequency within the Doppler profile of the line representing the hyperfine levels of the ground state of cesium. (6 refs.)

Stark broadening of the Paschen-beta line of hydrogen in a linear discharge .... See Entry 117830

32.20J Visible and ultraviolet spectra

(for fluorescence and phosphorescence spectra, see 32.50)

117821 Branching ratios in the vacuum ultraviolet spectrum of neutral carbon. G.P.Tozzi (Osservatorio Astrofisico di Arcetri, Firenze, Italy), M.C.E.Huber, U.Pauls.
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.320-4 (Oct. 1983).
The relative strengths of allowed and intercombination transitions out of the $3s^3P^0$, $2p^3\ ^3P^0$ and $^3D^0$, $3d^3P^0$ and $^3D^0$ as well as $4s^3P^0$ terms belonging to neutral carbon have been measured. Some of the allowed multiplets exhibit deviations from *LS*-coupling. Implications of the measurements regarding the

spectra of the interstellar medium of comets and chromospheres are mentioned. (28 refs.)

117822 On the scaling properties of the energy spectrum of hydrogen in a uniform magnetic field. H.Hasegawa, S.Adachi, H.Harada (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
J. Phys. A (GB), vol.16, no.14, p.L503-9 (1 Oct. 1983).
The magnetic-field scaling relation between the coordinates, momenta and the energy in the Hamiltonian for the Kepler motion in a uniform magnetic field, i.e. $H(\gamma^{-1/3}p, \gamma^{2/3}r; \gamma^{1/3}m, \gamma=1)=\gamma^{-2/3}H(p,r; m, \gamma)$, where $\gamma=B/B_0$ is the normalised field strength and m the constant value of the angular moment,um B-parallel component is shown to ensure a representation of the semiclassical energy spectrum: $E=(n+{}^1/_2)^{-2}f(\gamma^{1/3}(n+{}^1/_2), \gamma^{1/3}m)$, $m=0, \pm1, \ldots; n=0, 1, \ldots$. The authors discuss how the function f, in the two-dimensional approximation ($z=p_z=0, z//B$), can be constructed. (18 refs.)

117823 Observation of Na I inner shell-excited quartet terms. R.Frohling (Inst. fur Atom- und Festkorperphys. Freien, Univ. Berlin, Berlin, Germany), H.J.Andra.
Phys. Lett. A (Netherlands), vol.97A, no.9, p.375-6 (26 Sept. 1983).
Stokes parameters for Na I spectral lines after ion-beam surface interaction at grazing incidence were measured. The as yet unidentified line at 507.1 nm showed opposite polarization to that normally found in such experiments. Measurements after ion-atom collisions with charge state separation indicate that this line is a member of the neutral Na I-spectrum. Together with an unpublished calculation by Weiss of inner shell-excited term energies of Na atoms the analysis of the polarization suggests the line to stem from a transition inner shell-excited between the terms $3s3p^4D_{7/2}$-$3s4s^4P_{5/2}$ of neutral sodium. (8 refs.)

Electronic configuration mixing and isotope shifts in singly ionized dysprosium .... See Entry 117802

Stark broadening of lines from multiply-charged carbon ions in a high-density arc plasma .... See Entry 117829

^{2}P photoionization cross section of Sb I .... See Entry 117844

Continuous wave (CW) Doppler free two-photon frequency modulated (FM) spectroscopy .... See Entry 117847

Photofragmentation of HI in the first continuum .... See Entry 117941

Oscillator strengths of titanium and chromium ionic lines .... See Entry 121638

32.20R X-ray spectra

117824 Kα hypersatellites of Zr. S.I.Salem, A.Kumar (Dept. of Phys. & Astron., California State Univ., Long Beach, CA, USA).
Phys. Rev. A (USA), vol.28, no.4, p.2245-7 (Oct. 1983).
The $K\alpha$ hypersatellites $K\alpha_1{}^h$ and $K\alpha_2{}^h$ of zirconium were observed in a conventional X-ray spectrum analysis. The energy separation between the hypersatellites and their corresponding diagram lines were measured, and the intensity ratio $I(K\alpha_1{}^h)/I(K\alpha_2{}^h)$ was computed. The experimental values are in good agreement with the results of the most advanced calculations, except for the energy of the $K\alpha_2{}^h$ where the measured value is some 15 eV higher than the theoretical prediction. (16 refs.)

Precision measurement of the magnetic moment of the Σ^- hyperon .... See Entry 117465

Experimental atom-to-solid L-level shifts for Ce, Sm, Gd, and Er .... See Entry 120180

Measurements of relative intensities of L shell X-rays in some high Z elements .... See Entry 120188

32.50 FLUORESCENCE, PHOSPHORESCENCE

(inc. quenching)

117825 Theoretical determination of fine-structure transitions occurring in collisional redistribution of light. K.C.Kulander, F.Rebentrost (Max-Planck-Inst. fur Quantentoptik, Garching, Germany).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1262-4 (3 Oct. 1983).
Recent experimental results of Havey, Copeland, and Wang (1983) on the collisional redistribution of light by Na in Ar showed a dependence of the relative intensities of the Na D_1 and D_2 resonance lines on laser detuning. Calculations of these intensity ratios are reported. The agreement between theory and experiment obtained shows the importance of fine-structure transitions occurring during the dissociation of the excited-state molecule. (12 refs.)

117826 Subnatural-linewidth laser spectroscopy by phase switching. F.Shimizu (Dept. of Appl. Phys., Univ. of Tokyo, Tokyo, Japan), K.Shimizu, H.Takuma.
Phys. Rev. A (USA), vol.28, no.4, p.2248-53 (Oct. 1983).
A method to obtain subnatural resolution in laser-induced fluorescence spectroscopy by phase switching is described. The subnatural linewidth is obtained by extracting a coherent transient response induced by the switching of the laser. The linewidth in this type of spectroscopy is determined by the time interval between the switching and observation, instead of the spontaneous lifetime. The result is compared with the experiment on the Na D_1 line. (39 refs.)

Isotopic shift measurement of the $^3P_1$-$^3P_0$ fine structure transition of ^{24}Mg and ^{26}Mg .... See Entry 117835

Lamb shift and the lifetime of the $2^2S_{1/2}$ state of hydrogenlike argon ($Z=18$) .... See Entry 117836

Rb and Cs broadening of the Na resonance lines .... See Entry 117838

Measurement of total decay rates of excited states in a deuterium plasma by laser-resonance fluorescence .... See Entry 118756

32.60 ZEEMAN AND STARK EFFECTS

117827 The electric dipole moment of the fluorocarbene radical, HCF, in its $\tilde{X}^1A'$ and $A^{\sim1}A''$ electronic states. R.N.Dixon, N.G.Wright (School of Chem., Univ. of Bristol, Bristol, England).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.311-15 (16 Sept. 1983).
Stark shifts have been measured for a number of transitions in the origin band of the $A^{\sim1}A''$-$X^{\sim1}A'$ electronic transition in HCF, using Doppler-limited optical Stark spectroscopy. The transitions were observed in DC field of up to ≈20 kV/cm, and excited by a single-mode tunable dye laser. From the resolved M_J structure the following values for the a-axis components of the electric dipole moment were computed: $\mu_a''=0.061\pm0.005$ D, $\mu_a'=0.488\pm0.005$ D. These values are discussed and rationalised in terms of a simple model. The other component of the electric dipole moment, μ_b is also discussed though no measurements have been made upon it. (17 refs.)

117828 Influence of different collisional processes on the Stark broadening. M.S.Dimitrijevic, N.Feautrier, S.Sahal-Brechot (Obs. de Paris, Meudon, France).
Fizika (Yugoslavia), vol.15, no.3, p.205-12 (July-Sept. 1983).
Using a semiclassical formalism, elastic, inelastic and strong collision's contributions to the electron impact width of the Li I ($2s^2$ S-$2p^2$ P^0; $\lambda=670.78$ nm) resonance line have been computed for different angular momenta of the incoming perturbing electron and for $T=2500$, 10000 and 20000K. On the basis of the obtained results, the relative importance of elastic, inelastic and strong collision's contributions to the line width are discussed. (6 refs.)

117829 Stark broadening of lines from multiply-charged carbon ions in a high-density arc plasma. M.A.El-Farra, T.P.Hughes (Dept. of Phys., Univ. of Essex, Colchester, England).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.4, p.335-43 (Oct. 1983).
Profiles of C(III) and C(IV) lines emitted in the VUV and visible regions from a pulsed arc ($N_e=1.5\times10^{18}$ cm^{-3}, $T_e=5.3\times10^4$K) have been measured with time resolution. The experimental results are in satisfactory agreement with the predictions of electron impact theory for (3-3) and (3-4) transitions for which the energy separation between the upper level and the nearest perturbing level is smaller than the electron thermal energy. For lines from (2-2) transitions for which the plasma is optically thick, damping constants determined experimentally agree with theoretical values within a factor of two. (12 refs.)

117830 Stark broadening of the Paschen-beta line of hydrogen in a linear discharge. R.Castell, D.Mandelbaum, A.Mendez, A.Sanchez (Dept. de Fisica, Univ. Simon Bolivar, Caracas, Venezuela).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.4, p.345-9 (Oct. 1983).
Experimental profiles of the hydrogen Paschen-beta line have been measured in a helium plasma with 0.85% hydrogen. Electron densities were deduced from profiles of the He(I) line ($\lambda=4471.5$ Å) and are in the range 10^{14}-10^{15} cm^{-3}. The authors measurements are compared with theoretical calculations. (8 refs.)

117831 Stark effect in barium $6snd$ $^1D_2$ Rydberg states; evidence of strong perturbations in the $^1F_3$ series. K.A.H.van Leeuwen, W.Hogervorst, B.H.Post (Natuurkundig Lab., Vrije Univ., Amsterdam, Netherlands).
Phys. Rev. A (USA), vol.28, no.4, p.1901-7 (Oct. 1983).
The scalar and tensor polarizabilities of the barium $6snd$ $^1D_2$ states with principal quantum number n ranging from 14 to 30, as well as those of the $5d7d$ $^1D_2$ perturber state near $n=26$, have been measured with high-resolution laser-atomic-beam spectroscopy. The data are analyzed by calculating the contribution to the polarizabilities of all known odd-parity states connected via the electric dipole operator with the $^1D_2$ states. In this way the contributions of the unknown $6snf$ $^1F_3$ states are inferred. The results indicate that the $^1F_3$ series is heavily affected by at least two perturber states. A tentative three-channel quantum-defect-theory analysis of the $^1F_3$ series, based on a fit to the experimental polarizabilities, is presented. (30 refs.)

117832 Stark widths and shifts of singly ionized silicon spectral lines. A.Lesage (Obs. de Paris, CNRS, Meudon, France), B.A.Rathore, I.S.Lakicevic, J.Puric.
Phys. Rev. A (USA), vol.28, no.4, p.2264-8 (Oct. 1983).
Stark widths and shifts of Si II lines from five visible multiplets: (1) $3p^2$ ^2D-$4p$ $^2P^0$, (2) $4s$ ^2S-$4p$ $^2P^0$, (3) $3d$ ^2D-$4f$ $^2F^0$, (4) $4p$ $^2P^0$-$5s$ ^2S, and (5) $4p$ $^2P^0$-$4d$ ^2D, are measured in an electromagnetically driven T tube. Electron density [$(0.3$-$1.4)\times10^{17}$ cm^{-3}] is determined by laser interferometry, and from Hβ profiles. Temperature (16000-22000K) is obtained from the intensity ratios of Si III and Si II lines, and from Boltzmann slopes of Ne I lines. Results are compared with other experimental and theoretical data. (34 refs.)

117833 Tensor hyperpolarizability of the $6s19d$ $^1D_2$ barium Rydberg state. P.Kulina, R.-H.Rinkleff (Inst. fur Atom- und Molekulphys., Univ. Hannover, Hannover, Germany).
Z. Phys. A (Germany), vol.313, no.3, p.241-2 (1983).
Tensor polarizability and tensor hyperpolarizability of the 6s19d $^1D_2$ Rydberg state of barium were derived from Stark splittings measured by quantum beat spectroscopy. The hyperpolarizability appearing in the fourth order contribution of the perturbation expansion was expressed in spherical tensor form. Using the Coulomb aproximation numerical values were calculated which are in fair agreement with experimental results. (4 refs.)

Spectral quality of He-Zn II and He-Cd II hollow cathode metal vapor lasers in the magnetic fields .... See Entry 118188

Properties of the cadmium determination with the platform furnace and Zeeman background correction .... See Entry 120708

32.70 SPECTRAL LINE SHAPES AND INTENSITIES

117834 Information theory of line-shape in collision-induced absorption. Z.Gburski, C.G.Gray, D.E.Sullivan (Dept. of Phys., Univ. of Guelph, Guelph, Ontario, Canada).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.383-6 (16 Sept. 1983).
Information theory is used to interpret the line-shape of collision-induced absorption spectra of rare-gas mixtures. Numerical results and comparison with experiment are given for low-density Xe-Ar gas mixtures at 295K. (15 refs.)

117835 Isotopic shift measurement of the $^3P_1$-$^3P_0$ fine structure transition of ^{24}Mg and ^{26}Mg. E.Bava, A.De Marchi, A.Godone, G.D.Rovera (Istituto Elettrotecnico Nazionale, Galileo Ferraris, Turin, Italy), G.Giusfredi.
Opt. Commun. (Netherlands), vol.47, no.3, p.193-5 (1 Sept. 1983).
The isotopic frequency shift for the $^3P_1$-$^3P_0$ $\Delta m_j=0$ fine structure transition in the first metastable triplet of ^{24}Mg and ^{26}Mg is reported. The transitions corresponding to the two even isotopes of Mg have been observed via the fluorescence emission at 4751 Å of the intercombination line $^3P_1$-$^1S_0$ in a metastable atomic beam. The center frequencies have been measured with an uncertainty of 7×10^{-9}; the isotopic shift turned out to be 1706 ± 2 kHz. (7 refs.)

117836 Lamb shift and the lifetime of the $2^2S_{1/2}$ state of hydrogenlike argon ($Z=18$). H.Gould (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA), R.Marrus.
Phys. Rev. A (USA), vol.28, no.4, p.2001-25 (Oct. 1983).
The authors report a measurement of the Lamb shift in hydrogenlike argon based on the electric-field-quenching method, and a measurement of the unperturbed lifetime of the $2^2S_{1/2}$ state. They find the lifetime of the unperturbed $2^2S_{1/2}$ state to be 3.487(0.036) ns in agreement with the theoretical value of 3.496 ns. This is the first measurement of the $2^2S_{1/2}$ state lifetime of sufficient accuracy to observe the contribution to the total decay rate of the single-photon magnetic dipole decay. The authors' measured value of the

Lamb shift is $\delta E(2^2S_{1/2}\text{-}2^2P_{1/2})=37.89(0.38)$ THz, lower than, but in agreement with, Mohr's value of 38.25(0.025) THz, and 2.7 standard deviations below Erickson's value of 39.01(0.16) THz. Both the quenched and natural lifetimes were measured by the beam-foil time-of-flight technique. In this paper the authors emphasize the treatment of the systematic effects in the beam-foil time-of-flight method including cascades from higher excited states, interference from the spectra of heliumlike ions, collisions in the residual gas, and perturbations from a highly excited extra electron, as well as systematic effects more unique to electric field quenching. (90 refs.)

117837 Isotope shifts of energy levels in the naturally abundant isotopes of strontium and calcium. C.-J.Lorenzen, K.Niemax (Inst. fur Experimentalphys., Univ. Kiel, Kiel, Germany), L.R.Pendrill.
Phys. Rev. A (USA), vol.28, no.4, p.2051-8 (Oct. 1983).
The isotope shifts of long series of spectral lines in the optical spectra of the alkaline earth elements Ca and Sr have been measured by Doppler-free, two-photon laser spectroscopy with a thermionic diode. The variation of transition isotope shifts with transition energy yields the level isotope shifts with reference to the ionization limit and how these shifts vary with the binding energy of the optically active electron. The largest isotope shifts of levels in these elements appear to arise from the specific-mass effect in the presence of state mixing. (20 refs.)

117838 Rb and Cs broadening of the Na resonance lines. B.Kamke, W.Kamke, K.Niemax, A.Gallagher (Joint Inst. for Lab. Astrophys., NBS & Univ. of Colorado, Boulder, CO, USA).
Phys. Rev. A (USA), vol.28, no.4, p.2254-63 (Oct. 1983).
The broadening of the Na resonance lines, due to collisions with Rb and with Cs, has been measured with the use of the normalized fluorescence-intensity method of Chatham, Lewis, and Gallagher (1980). Several Na resonance-radiation diffusion and absorption corrections were necessary in the Rb case, due to an unavoidable excess of Na density in the Rb vapor. The line-broadening rate coefficients k_1 and k_2 for the D_1 and D_2 resonance lines are $k_1(\text{Rb})=(6.2\pm0.4)\times10^{-9}$ cm^3 s^{-1}, $k_2(\text{Rb})=(5.5\pm0.6)\times10^{-9}$ cm^3 s^{-1}, $k_1(\text{Cs})=(6.9\pm1.0)\times10^{-9}$ cm^3 s^{-1}, and $k_2(\text{Cs})=(5.5\pm0.9)\times10^{-9}$ cm^3 s^{-1} at $T\simeq300$°C. The leading (C_6R^{-6}) dipole-dipole long-range dispersion forces for the Na-Rb and Na-Cs interactions are calculated, and are used in the impact-theory formula to obtain theoretical line-broadening rate coefficients. These are in poor agreement with the measurements, indicating that as suggested by Vadla, the higher-order (C_8R^{-8}) dispersion terms are also important at the very long range responsible for this line broadening. (18 refs.)

117839 Natural radiative lifetimes in the $^2S_{1/2}$ and $^2D_{5/2,3/2}$ sequences of aluminum. G.Jonsson, H.Lundberg (Dept. of Phys., Lund Inst. of Technol., Lund, Sweden).
Z. Phys. A (Germany), vol.313, no.3, p.151-4 (1983).
Natural radiative lifetimes have been measured for the $3s^2ns$ $^2S_{1/2}$ ($n\leq10$) and $3s^2$nd $^2D_{5/2,3/2}$ ($n\leq11$) sequences of aluminum using pulsed laser excitation of an atomic beam. The investigated states were populated from the ground configuration using UV pulses of wavelength down to 210 nm produced by a Nd:YAG-or an excimer-pumped dye-laser system. The S-state lifetimes increase regularly with increasing principal quantum number but this is not the case for the D sequence. (9 refs.)

Stochastic aspects in the theory of spectral-line broadening. I. Collision time statistics and N-perturber limit .... See Entry 117082

Stochastic aspects in the theory of spectral-line broadening. II. Noncommutative cluster expansions .... See Entry 117083

Measurement of frequency shifts using infrared or Raman difference spectroscopy .... See Entry 117241

Electronic configuration mixing and isotope shifts in singly ionized dysprosium .... See Entry 117802

Magnetic resonance of cesium atoms in the case of optical pumping by radiation from a single-mode injection laser .... See Entry 117820

Theoretical determination of fine-structure transitions occurring in collisional redistribution of light .... See Entry 117825

Influence of different collisional processes on the Stark broadening .... See Entry 117828

Stark broadening of lines from multiply-charged carbon ions in a high-density arc plasma .... See Entry 117829

Stark broadening of the Paschen-beta line of hydrogen in a linear discharge .... See Entry 117830

Continuous wave (CW) Doppler free two-photon frequency modulated (FM) spectroscopy .... See Entry 117847

Investigations on the thermionic diode: the ionisation probability of Rb n^2P_J atoms by noble gas collisions .... See Entry 117957

Nonlinear plasma spectroscopy of the hydrogen Balmer-α line .... See Entry 118750

Oscillator strengths of titanium and chromium ionic lines ..... See Entry 121638

32.80 PHOTON INTERACTIONS WITH ATOMS

Quasienergetic method in the theory of opticocollisional transitions .... See Entry 117961

Observation of self-induced Rabi oscillations in two-level atoms excited inside a resonant cavity: the ringing regime of superradiance .... See Entry 118108

32.80B Level crossing and optical pumping

Magnetic resonance of cesium atoms in the case of optical pumping by radiation from a single-mode injection laser .... See Entry 117820

Explicit Hilbert-space representations of atomic and molecular photoabsorption spectra: computational studies of Stieltjes-Tchebycheff functions .... See Entry 117930

Population inversion in thallium by flashlamp-photodissociation of TlI .... See Entry 118121

32.80D Autoionization

117840 Resonance and intermediate-coupling effects in electron scattering with highly charged ions. II. Autoionization and dielectronic recombination. A.K.Pradhan (Dept. of Phys., Univ. of Windsor, Windsor, Ontario, Canada).
Phys. Rev. A (USA), vol.28, no.4, p.2128-36 (Oct. 1983).
For pt.I see ibid., vol.28, no.4, p.2113 (1983). The role of resonances in electron-impact excitation of highly charged ions is examined and some methods are described in order to take account of autoionization and dielectronic recombination. The intermediate-coupling calculations of paper I (1983) are extended to include these processes and effective collision strengths are obtained. Results are presented to illustrate particular features in a number of transitions in Fe^{24+} and Mo^{40+}. Resonance analysis is carried out employing numerical interpolation techniques and multichannel quantum-defect theory, employing reactance matrices in nine-state close-coupling and distorted-wave approximations. It is shown that all three effects considered in the present study, departure from LS coupling, resonance enhancement due to autoionization, and reduction in autoionization enhancement due to dielectronic recombinations, can be of considerable importance in the cross sections of highly ionized systems. In the high-Z ions of the helium isoelectronic sequence the contribution of autoionizing resonances remains large even after all probable radiative channels are included, although the net autoionization effect decreases with Z. (13 refs.)

117841 Laser-induced autoionization in the presence of radiative damping and transverse relaxation. J.W.Haus, M.Lewenstein (Fachbereich Phys., Univ. Essen, Essen, Germany), K.Rzazewski.
Phys. Rev. A (USA), vol.28, no.4, p.2269-81 (Oct. 1983).
A model for laser-induced autoionization is considered which includes two qualitatively different relaxation mechanisms: radiation damping to the ground state and phase fluctuations. Analytic solutions are presented for the first- and second-moment correlation functions of the atomic and photon operators in the Heisenberg picture. The authors present an explicit analysis of the spectrum of emitted photons at long times and investigate the effect of both relaxation mechanisms, as well as the influence of detuning and laser intensity, on this photoemission spectrum. (19 refs.)

Atomic photoionization in a strong magnetic field .... See Entry 117846

32.80F Photoionization and photodetachment

117842 Theoretical study of shake-up in the core photoelectron spectra of the alkali atoms. G.De Alti, P.Decleava, A.Lisini (Istituto di Chimica, Univ. di Trieste, Trieste, Italy).
Chem. Phys. (Netherlands), vol.80, no.3, p.229-35 (15 Oct. 1983).
Relativistic and nonrelativistic Hartree-Fock calculations have been performed for the shake-up lines relative to core ionization of the alkali atoms. Good general agreement with the experimental data is achieved both for the energy and the intensity. Relativistic effects are small, amounting to $\approx$0.2 eV in Cs. As concerns the shake-up energies, a correlation effect is detected, the magnitude of which increases along the series. (44 refs.)

117843 Secondary ionisation processes in laser-induced cascade ionisation. Y.E.Gamal, M.A.Harith (Dept. of Phys., Cairo Univ., Giza, Egypt).
J. Phys. D (GB), vol.16, no.10, p.1901-6 (14 Oct. 1983).
The effects of the two-step ionisation and photoionisation from excited states of helium and argon gases are studied using a more realistic theoretical model for cascade ionisation. Two sets of experimental data were investigated, covering the wavelength range 720-840 nm with laser light pulse duration 18 ns and 40 ns at two different pressures, 760 Torr and 1.064×10^4 Torr. These investigations show the importance of the photoionisation of excited atoms at atmospheric pressure, while at higher pressure the collisional ionisation processes dominate. (8 refs.)

117844 ^{2}P photoionization cross section of Sb I. M.Mazzoni (Istituto di Astron., Florence, Italy).
Phys. Lett. A (Netherlands), vol.97A, no.9, p.381-3 (26 Sept. 1983).
A very wide absorption feature has been observed in the atomic spectrum of neutral antimony, appearing at about 196 nm. It has been identified as the continuous absorption due to bound-free transitions from the ^{2}P term of the ground configuration. (9 refs.)

117845 Angular distributions and quantum beats of photoelectrons from resonant two-photon ionization of lithium. Ring-lin Chien, O.C.Mullins, R.S.Berry (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
Phys. Rev. A (USA), vol.28, no.4, p.2078-84 (Oct. 1983).
Angular distributions of photoelectrons from resonant two-photon ionization via the $2p$ $^2P_{1/2}$ or $2p$ $^2P_{3/2}$ state of lithium have been measured. The quantum beats of hyperfine levels strongly affect the angular distribution. Three microscopic parameters are extracted: the ratio of the radial matrix elements from $2p$ excited states to $l=0$ and 2 final states, the difference of the phase shifts of the continuum electrons in final channels, and a time-dependent parameter for hyperfine interaction. The experimental results agree with theoretical quantum-defect calculation and extrapolated bound-state data. (15 refs.)

117846 Atomic photoionization in a strong magnetic field. C.H.Greene (Dept. of Phys. & Astron., Louisiana State Univ., Baton Rouge, LA, USA).
Phys. Rev. A (USA), vol.28, no.4, p.2209-16 (Oct. 1983).
The photoionization of hydrogen atoms in a strong magnetic field is formulated as a multichannel problem by representing the asymptotic electron wave function in cylindrical coordinates. Departures from cylindrical symmetry close to the nucleus are incorporated by an R-matrix treatment at short range, which then merges with standard quantum-defect procedures. The R-matrix calculation utilizes the eigenchannel approach, recast in noniterative form. At the field strength treated $B=4.7\times10^9$ G, the photoionization cross section displays narrow 'autoionizing' resonances near the excited Landau thresholds. (37 refs.)

Sensitivity factors for XPS analysis of surface atoms .... See Entry 116934

Laser-induced autoionization in the presence of radiative damping and transverse relaxation .... See Entry 117841

Explicit Hilbert-space representations of atomic and molecular photoabsorption spectra: computational studies of Stieltjes-Tchebycheff functions .... See Entry 117930

32.80K Multiphoton processes

117847 Continuous wave (CW) Doppler free two-photon frequency modulated (FM) spectroscopy. W.Zapka, M.D.Levenson, G.C.Bjorklund, A.C.Tam, F.M.Schellenberg (IBM Res. Lab., San Jose, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.352-6 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Doppler-free two-photon absorption and two-photon dispersion spectra of Rb^{87} have been taken by FM spectroscopy. Sensitivity achieved is comparable to fluorescence detection. The technique can be readily applied where fluorescence is difficult to detect. (15 refs.)

117848 Atoms in circularly polarised fields: the dilation-analytic approach. A.Tip (Fom-Inst. for Atomic & Molecular Phys., Amsterdam, Netherlands).
J. Phys. A (GB), vol.16, no.14, p.3237-59 (1 Oct. 1983).
The time-evolution operator associated with an atom in a circularly polarised radiation field can be factorised as $U(t)=\exp[-i\omega J_3 t]\exp[-iHt]$, where J_3 is the component of the total angular momentum orthogonal to the two field components and H can explicitly be given in terms of the atomic Hamiltonian. The author establishes for a one-electron model the self-adjointness of H and in addition he develops a complex dilation theory for this operator. The purpose of this approach is to obtain an analytic continuation theory for multiphoton processes so that the imaginary parts of the complex eigenvalues of the complex dilated Hamiltonian $H(\zeta)$ can be related to the various rate constants that govern such processes. (40 refs.)

Angular distributions and quantum beats of photoelectrons from resonant two-photon ionization of lithium ...... See Entry 117845

32.90 OTHER TOPICS IN ATOMIC SPECTRA AND INTERACTIONS WITH PHOTONS

117849 Exact solution for spontaneous emission in the presence of N atoms. F.W.Cummings, Ali Dorri (Dept. of Phys., Univ. of California, Riverside, CA, USA).
Phys. Rev. A (USA), vol.28, no.4, p.2282-5 (Oct. 1983).
N two-level 'atoms' are considered in interaction with a single-mode resonant electromagnetic field. The exact solution is given nonrelativistically for all times for the case of spontaneous emission, when only one atom is initially excited. The solution is given for the general case of the N atoms in inequivalent mode positions. (7 refs.)

Recurrent algorithm solution of an infinite series of linear differential equations using a triangular matrix ...... See Entry 117811

Observation of self-induced Rabi oscillations in two-level atoms excited inside a resonant cavity: the ringing regime of superradiance ...... See Entry 118108

33.00 MOLECULAR SPECTRA AND INTERACTIONS WITH PHOTONS

33.10 CALCULATION OF MOLECULAR SPECTRA

117850 Electric field gradient and force constant in nitriles. Y.Aray (Centro de Quimica, Inst. Venezolano de Investigaciones Cientificas, Caracas, Venezuela), J.Murgich.
THEOCHEM (Netherlands), vol.13, no.1-2, p.23-35 (Sept. 1983).
The relationship between the principal component of the electric field gradient (eq_N) and the stretching force constant (k_{CN}) obtained by Salem for diatomic molecules is extended to polyatomic molecules with linear fragments of type R-C-N. It is found that for nitriles there is a linear correlation between k_{CN} and eq_N values, as predicted by theory, and that such correlation depends on the degree of conjugation between R and CN orbitals. (31 refs.)

117851 Vibrational spectra of some N-methyl-halogenotriazoles-1,2,4. M.S.Idrissi, M.Senechal (Lab. de Spectroscopie Infrarouge, Faculte des Sci., Rabat, Maroc), H.Sauvaitre, C.Garrigou-Lagrange.
Can. J. Chem. (Canada), vol.61, no.9, p.2133-6 (Sept. 1983). In French.
Vibrational spectra of some *N*-methyl chloro and *N*-methyl bromotriazoles-1,2,4 are reported. An assignment of the normal modes is proposed. This study was done in order to find new elements to solve the problem of tautomerism in *C*-substituted triazoles-1,2,4. (17 refs.)

117852 HCl vibrational distribution in the dissociation of vinyl chloride activated by flash photolysis of 3-chloro-3-methyldiazirine. R.Becerra, M.Catillejo, J.M.Figuera, M.Martin (Inst. de Quimica Fisica 'Rocasolana', Madrid, Spain).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.340-4 (16 Sept. 1983).
HCl vibrational state populations produced in the dissociation of vinyl chloride activated by flash photolysis of 3-chloro-3-methyldiazirine were measured in an oscillator amplifier chemical laser arrangement. HCl populations can be characterized by a linear surprisal plot of slope $\lambda_v=-5.5$. (22 refs.)

117853 Vibrational analysis of SiH_2F_2 and SiD_2F_2. A.Natarajan, S.Rajendran (Dept. of Phys., Bharathidasan Univ., Tamilnadu, India).
Can. J. Spectrosc. (Canada), vol.28, no.3, p.95-9 (1983).
The potential energy constants of SiH_2F_2 and SiD_2F_2 have been evaluated on the basis of a general valence force field. The mean amplitudes of vibration, the generalized mean-square amplitudes of vibration, shrinkage constants, Coriolis coupling constants and rotation distortion constants have also been computed and are presented. (16 refs.)

117854 Rotational perturbations in the $CN(B^2\Sigma^+-X^2\Sigma^+)$ tail band system. I. Analysis of the $v=27$ and 30 levels of $CN(A^2\Pi_i)$. Y.Ozaki, T.Nagata, K.Suzuki, T.Kondow, K.Kuchitsu (Dept. of Chem., Univ. of Tokyo, Tokyo, Japan).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.73-84 (Oct. 1983).
The perturbed rotational lines observed in the $CN(B^2\Sigma^+-X^2\Sigma^+)$ 12-12 and 14-14 bands are assigned. The vibrational levels, the rotational constants, and the spin-orbit interaction constants of the perturbing states, $CN(A^2\Pi_i)$ $v=27$ and 30, are determined. An RKR potential for the $CN(A^2\Pi_i)$ state is obtained up to $v=30$, and an approximate RKR potential is estimated by extrapolation up to the dissociation limit, $v=61$. The electronic terms of the perturbation constants between the $CN(A^2\Pi_i)$ and $CN(B^2\Sigma^+)$ states $H_{el}{}^{RE}$, are determined for $(v_A, v_B)=(24, 10), (27, 12)$ and $(30, 14)$. These constants are found to be nearly equal to the corresponding constants governing the interaction between the $N_2{}^+(A^2\Pi_u)$ and $N_2{}^+(B^2\Sigma_u{}^+)$ states. (32 refs.)

117855 X-ray and theoretical analysis of the relationship between substituent steric effects and the structure of bicyclo[1.1.0]butane. The unexpected flexibility of the bicylco[1.1.0]butane skeleton. P.G.Gassman, M.L.Greenlee, D.A.Dixon, S.Richtsmeier, J.Z.Gougoutas (Dept. of Chem., Univ. of Minnesota, Minneapolis, MN, USA).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5865-74 (7 Sept. 1983).
Single-crystal X-ray analyses have been run for the three possible stereoisomers of 1,3-diphenyl-2,4-bis(meth-oxycarbonyl)bicyclo[1.1.0]butane. The endo-endo, exo-endo, and exo-exo diester interflap angles were 127.2°, 121.2°, and 113.4°, respectively, which showed surprising flexibility in the bicyclo[1.1.0]butane skeleton. As the interflap angle decreased, the C1-C3 bond lengths shortened (1.558, 1.498, and 1.455 Å, respectively). The brigehead phenyl groups moved closer together as the interflap angle increased. This counter-intuitive movement of the bridgehead substituents necessitated that a least-motion discontinuity was required for any process involving flap inversion of the bicyclo[1.1.0]butane skeleton, a theoretical study of the relationship between the interflap angle and the other bonding parameters was carried out for bicyclo[1.1.0]butane with both fully optimized HF-SCF and a generalized valence bond (GVB) approach in the PRDDO approximation. These calculations covered the range of interflap angles from 99° to 180° (planar bicyclo[1.1.0]butane). Our calculations corroborate the experimentally determined structural relationships and extend beyond what is experimentally determined. Discontinuity occurred at interflap angle of 150±2°, where the bridgehead substituents ceased their inward migration and subsequently moved outward as the interflap angle proceeded from 150° to 180°. At an interflap angle of 180° the molecule lacked D_{2h} symmetry with the bridgehead hydrogens being out of the four-carbon plane by approximately 30°. The inversion barrier for a shift of these bridgehead hydrogens from one side of the four-carbon plane to the other side was calculated to be 4 kcal/mol. (29 refs.)

117856 Comment on 'Nonadiabatic treatment of the intensity distribution in the *V-N* bands of ethylene'. R.McDiarmid (Lab. of Chem. Phys., Nat. Inst. of Arthritis, Diabetes & Digestive & Kidney Diseases, Nat. Inst. of Health, Bethesda, MD, USA).
J. Chem. Phys. (USA), vol.79, no.6, p.3170-1 (15 Sept. 1983).
For original paper see C. Petrongolo et al., ibid., vol.76, p.3655 (1982). In a recent theoretical investigation the intensity distribution of the vibrational subbands of the *V-N* transition of ethylene was calculated and presented. The theoretical and experimental intensities were said to be in satisfactory agreement, although a truly quantitative comparison was said not to be possible because oscillator strengths were calculated and extinction coefficients were measured. Contrary to the above assertion, the author feels it is possible to make a quantitative comparison of the experimental and theoretical intensities. (4 refs.)

117857 Rotational energy of the hydrogen molecular ion in a magnetic field. S.A.Maluendes, F.M.Fernandez, E.A.Castro (Inst. de Investigaciones Fisiquimicas Teoricas y Aplicadas, La Plata, Argentina).
Phys. Rev. A (USA), vol.28, no.4, p.2059-64 (Oct. 1983).
A general method which combines hypervirial relations with the Hellmann-Feynman theorem and perturbation theory is applied in order to calculate the rotational eigenvalues of the hydrogen molecular ion in a magnetic field. Analytical expressions as well as numerical results are presented for both low and high field strengths. (26 refs.)

117858 Intracollisional interference in the pure rotational spectrum of HD: determination of the permanent electric dipole moment. J.B.Nelson, G.C.Tabisz (Dept. of Phys., Univ. of Manitoba, Winnipeg, Manitoba, Canada).
Phys. Rev. A (USA), vol.28, no.4, p.2157-61 (Oct. 1983).
The intensity of the pure rotational absorption spectrum of gaseous HD is measured as a function of density for pure HD and HD-He and HD-Ar mixtures. The decrease in the absorption coefficient with increasing density is consistent with a destructive intracollisional interference between the transitions involving the permanent and collision-induced dipole moments. The permanent dipole moment of the molecule in its ground vibrational state is found to be J dependent and in the range $(8-10)\times10^{-4}$ D. (31 refs.)

117859 Methylpyridines: vibrational assignments and an approximate force field. J.A.Draeger (Bartlesville Energy Technol. Center, US Dept. of Energy, Bartlesville, OK, USA).
Spectrochim. Acta Part A (GB), vol.39A, no.9, p.809-25 (1983).
Molecular vibrational analysis of pyridine and its deuterium and methyl derivatives was carried out to establish consistent vibrational assignments for use in statistical thermodynamic calculations. A 46-parameter modified valence force field was determined. The average error between the 777 observed and calculated frequencies is 7.8 cm^{-1} or 0.98%. (34 refs.)

117860 Normal coordinate treatment of liquid water and calculation of vapor pressure isotope effects. B.Gellai (Central Res. Inst. for Phys., Budapest, Hungary), W.A.Van Hook.
In *Collection of scientific papers in collaboration with joint Institute for Nuclear Research, Dubna, USSR and Central Research Institute for Physics, Budapest, Hungary. Algorithms and programs for solution of some problems in physics. Vol.IV*, p.127-58. Report KFKI-1983-21, Hungarian Acad. Sci., Budapest (1983), 191 pp.
A vibrational analysis of liquid water is reported, assuming a completely hydrogen-bonded network with continuously varying strengths of the hydrogen bonds. Frequency distribution calculations are made for intramolecular stretching and bending modes and for the intermolecular frequency region. The calculated distributions are compared with the experimental spectroscopic ones. As another test vapor pressure isotope effects are calculated from the theoretical distributions for some isotopic water molecules. Results are compared with ones of other authors obtained from a mixture model. (42 refs.)

The formate anion: an ab initio study of its equilibrium structure, general harmonic force field and fundamental vibrational frequencies ...... See Entry 117752

Pseudopotential local-spin-density calculations for Si_2 ...... See Entry 117770

Ab initio study of the vibrational spectrum and geometry of oxetane. I. Interpretation of the vibrational spectra ...... See Entry 117772

Compliant fields for water, ammonia, and methane ...... See Entry 117777

Theoretical force field and vibrational spectrum of maleimide by the CNDO/2 force method ...... See Entry 117779

Theoretical equilibrium geometry, vibrational frequencies and the first electronic transition energy of HCC ...... See Entry 117799

Substituent perturbation on masked ^1L_b-$^1A_1$ transition of anthracene monosulphonates: detection by photoselection in glycerol glass at 77K ...... See Entry 117862

The collision-induced far-infrared absorption band of gaseous methane in the region 30-900 cm^{-1} ...... See Entry 117865

Vibrational predissociation of Van der Waals clusters of ethylene ...... See Entry 117866

Vibrational spectra of some aminonitrotoluenes ...... See Entry 117868

Infrared studies of molecular ions. I. The ν_3 and of $NH_4{}^+$ ... See Entry 117870

The ν_3 vibrational spectrum of the free ammonium ion ($NH_4{}^+$) ...... See Entry 117871

Collision induced rotational spectrum of allene ...... See Entry 117873

Infrared spectra of N-substituted hydroxamic acids ...... See Entry 117874

Vibrational spectrum of 1,3,5-triamino-2,4,6-trinitrobenzene . See Entry 117875

Raman spectroscopic studies on the vibrational relaxation of benzonitrile in benzene solution ...... See Entry 117878

Depolarized Rayleigh scattering—temperature dependence of molecular reorientation of CO_2 at constant density ....See Entry 117880

Rotational perturbations in the CN($B^2\Sigma^+$-$X^2\Sigma^+$) tail band system. II. Identification of the CN($^4\Pi$) state and its vibrational levels ....See Entry 117886

Solute-solvent interactions: nuclear relaxation of nitric oxide solutions in perfluoro solvents ....See Entry 117893

Observation of the $\nu_3 \rightarrow (2\nu_3, A_1)$ band of methane ....See Entry 117899

Coriolis effects on 'intermediate case' of intramolecular vibrational relaxation: rotational-temperature dependence of energy-resolved fluorescence from jet-cooled perylene with 776-975 cm^{-1} excess energies ....See Entry 117904

IR multiple-photon excitation distribution probed by IR fluorescence ....See Entry 117905

Shape resonances in the valence-shell photoionization of cyanogen ....See Entry 117932

Determination of rotational alignment of $N_2{}^+B^2\Sigma_u{}^+$ and $CO^+B^2\Sigma^+$ following photoionization of N_2 and CO ....See Entry 117940

Vibrational interaction potentials .... See Entry 117955

Close-coupling calculations of polarized rotational cross sections for (Ar, LiF) ....See Entry 117962

A method for predicting the anharmonicity constants $\omega_e\chi_e$ of halides of sodium ....See Entry 118015

The vibrational spectrum of anisole ....See Entry 120092

OH($X^2\Pi$) state distribution from HNO_3 and H_2O_2 photodissociation at 193 nm ....See Entry 120653

33.20 MOLECULAR SPECTRA GROUPED BY WAVELENGTH RANGES

(for magneto-optical and electro-optical spectra, see 33.45; for fluorescence and phosphorescence spectra, see 33.50; for photoelectron spectra, see 33.65)

117861 Spectroscopic study of 2-amino-4-cyano-3-phenyl-5-(p-chlorophenyl)-furane in various solvents. M.Sanchez Gomez, J.M.Guerra Perez (Facultad de Ciencias Fisicas, Univ. Complutense, Madrid, Spain).
An. Fis. Ser. B (Spain), vol.79, no.2, p.171-81 (May-Aug. 1983). In Spanish. [received: Oct. 1983]
The 2-amino-4-cyano-3-phenyl-5-(p-chlorophenyl)-furane (ACDF-2) absorption and corrected fluorescence spectra are given. The natural fluorescence lifetime and oscillator strength have been calculated. The obtained value suggest a $\pi 1 \rightarrow \pi^*$ electronic transition. The solvent influence on the oscillator strength is discussed briefly. (28 refs.)

117862 Substituent perturbation on masked ^1L_b-$^1A_1$ transition of anthracene monosulphonates: detection by photoselection in glycerol glass at 77K. S.Basu, K.K.Rohatgi-Mukherjee (Dept. of Chem., Jadavpur Univ., Calcutta, India).
Indian J. Chem. A, vol.22A, no.3, p.186-91 (March 1983). [received: Oct. 1983]
Attempts are made to detect the long axis polarized weakly absorbing ^1L_b bands in anthracene 1-sulphonate (1-AS) and anthracene 2-sulphonate (2-AS) in glycerol glass by the method of photoselection. The unpolarized fluorescence spectra and excitation (absorption) spectra are separated into two component spectra based on short and long axis polarized transition dipoles and detailed vibrational analysis is made. From a comparison of the Franck-Condon envelope it has been concluded that the vibration bands around 31746 cm^{-1} in 1-AS and 30395 cm^{-1} in 2-AS in excitation spectra are mainly due to the ^1L_b band. The perturbation of the ^1L_b band due to substitution in 1- and 2-positions of the anthracene moiety is discussed. (31 refs.)

Influence of electron correlation on the spectra of streptopolymethines ....See Entry 117797

The absorption spectrum resonance structure of diatomic molecules near the ionization threshold ....See Entry 117933

Electron impact dissociation of simple molecules ....See Entry 117993

33.20B Radiofrequency and microwave spectra

(for NMR spectra, see 33.25; for EPR spectra, see 33.30)

Multiphoton transitions in gases at microwave frequencies .... See Entry 117947

Millimeter wave spectroscopic studies of collision-induced energy transfer processes in the $^{13}CH_3F$ laser ....See Entry 118123

33.20E Infrared spectra

117863 Specifications for infrared reference spectra of molecules in the vapor phase, prepared by the vapor phase subcommittee of the Coblentz Society spectral evaluation committee. P.R.Griffiths (Univ. of California, Riverside, CA, USA), A.R.H.Cole, P.L.Hanst, W.J.Lafferty, R.J.Obremski, J.H.Shaw, R.N.Jones.
Appl. Spectrosc. (USA), vol.37, no.5, p.458-63 (Sept.-Oct. 1983).
Many infrared spectrometers are now mini- and microcomputer controlled, and can readily generate data in digital form for archival storage. In order for digitally stored data to be readily transferable from one site to another, it is necessary to ensure that the format of the stored information is as uniform as possible. In the document the authors are not only proposing specifications for the measurement and presentation, as hard copy, of infrared reference spectra of molecules in the vapor phase, but also for formatting digitally stored reference data on magnetic tape. (11 refs.)

117864 Electronic and infrared spectra of iodoline. N.K.Sanyal, S.L.Srivastava, S.R.Tripathi (Dept. of Phys., Univ. of Gorakhpur, Gorakhpur, India).
Acta Phys. Pol. A (Poland), vol.A64, no.3, p.315-21 (Sept. 1983).
Electronic absorption spectrum of 2,3-dihydroindole was photographed in the region 3163-2920 Å in vapour phase. The (0, 0) band of the spectrum has been identified at 3130.9 Å (31930 cm^{-1}). All bands obtained are explained in terms of the ground state (215 cm^{-1}) and excited state (268, 423, 665, 792, 939, 1011, 1220 and 1314 cm^{-1}) fundamentals, their combinations and overtones. Fundamentals obtained are correlated with their corresponding infrared values which were recorded in the region 400-4000 cm^{-1} in liquid phase. The shift in the 0-0 band towards higher wavelength region has been attributed to cyclic or hyperconjugation. (25 refs.)

117865 The collision-induced far-infrared absorption band of gaseous methane in the region 30-900 cm^{-1}. G.Birnbaum, L.Frommhold, L.Nencini, H.Sutter (NBS, Washington, DC, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.292-6 (9 Sept. 1983).
The collision-induced rotational band of CH_4 has been measured at 195K from $\approx$30 to 900 cm^{-1}. These results have been analyzed with a quantum-mechanical lineshape which shows that this spectrum can be understood on the basis of octupole- and hexadecapole-induced dipoles. However, this analysis has revealed the role of bound and predissociating dimers in the spectrum. (18 refs.)

117866 Vibrational predissociation of Van der Waals clusters of ethylene. G.Fischer, R.E.Miller, R.O.Watts (Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.147-55 (Oct. 1983).
Infrared laser spectroscopy and quadrupole mass spectrometry have been used to study clusters of ethylene molecules formed in a free jet expansion. Vibrational spectra in the range 2950-3200 cm^{-1} show structure corresponding to the predissociation of clusters as a result of exciting them near ν_1, ν_{11} and ν_9 fundamentals, as well as the $\nu_2+\nu_{12}$ combination band. These results provide valuable information concerning the structures and dissociation mechanisms for ethylene clusters. In all cases the vibrational bands show lorentzian lineshapes of $\approx$5 cm^{-1} fwhm, suggesting that the dominant broadening mechanism is homogeneous. Estimates of the excited-state lifetimes can therefore be obtained directly from these widths. (20 refs.)

117867 Infrared and nuclear magnetic resonance studies pertaining to the cage model for solutions of acetone in water. M.C.R.Symons, G.R.Eaton (Dept. of Chem., Univ. of Leicester, Leicester, England).
Faraday Symp. Chem. Soc. (GB), no.17, p.31-40 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
Solutions of acetone in water show a single C=O stretching mode in the infrared (1697 cm^{-1}), which is assigned to acetone hydrogen bonded to two water molecules. On cooling below 0°C new features appear which are characteristic of concentrated solutions of acetone, formed by growth of ice crystals. These bands are assigned to acetone forming single hydrogen bonds (1708 cm^{-1}) and no hydrogen bonds (1715 cm^{-1}). The latter band is characteristic of bulk acetone. On standing at ca. $-30°C$, all these features decay, and ultimately only a single narrow band is detectable at 1722 cm^{-1}, which is characteristic of isolated acetone molecules in completely inert solvents. This change is clearly a result of clathrate formation. These results demonstrate unequivocally that acetone in liquid water is solvated in a manner that differs completely from cage 'solvation'. This remarkable difference between solid and fluid systems is interpreted in terms of the presence of large concentrations of free OH groups in liquid water. (43 refs.)

117868 Vibrational spectra of some aminonitrotoluenes. R.B.Singh, D.K.Rai (Dept. of Phys., Banaras Hindu Univ., Varanasi, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.812-15 (Oct. 1982). [received: April 1983]
The infrared spectra of 2-amino 4-nitrotoluene, 2-amino 5-nitrotoluene, 4-amino 2-nitrotoluene and 4-amino 3-nitrotoluene have been recorded in the region 200-4000 cm^{-1}. The polarized and depolarized laser Raman spectra have also been recorded for 2-amino 4-nitrotoluene and 4-amino 3-nitroluene molecules. The assignments of the observed frequencies to the probable modes of vibration of the molecules are given. (17 refs.)

117869 Argon matrix investigation of the 1:1 molecular complexes of silicon tetrafluoride with water, methanol, and dimethyl ether. B.S.Ault (Dept. of Chem., Univ. of Cincinnati, Cincinnati, OH, USA).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5742-6 (7 Sept. 1983).
The codeposition of SiF_2 with a variety of oxygen-containing bases in inert matrices at 15K has given rise to a number of novel 1:1 adducts. The spcies $H_2O.SiF_4$, $CH_3OH.SiF_4$, and $(CH_3)_2O.SiF_4$ were each identified and characterized spectroscopically. The most prominent feature of the infrared spectrum of each adduct was an intense Si-F stretching mode between 960 and 990 cm^{-1}. The position of this mode correlated linearly with the degree of base character of the Lewis base in the complex. Additional modes of the 1:1 complex were observed as well, including modes of the perturbed base subunit in the adduct. These modes showed little shift from the position of the free, isolated base, including a quite weak, but specific, interaction with SiF_4. No evidence of a 1:2 adduct was noted under these experimental conditions. (33 refs.)

117870 Infrared studies of molecular ions. I. The ν_3 and of $NH_4{}^+$. M.W.Crofton, T.Oka (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.79, no.6, p.3157-8 (15 Sept. 1983).
Recently Gudeman, Begemann, Pfaff, and Saykally (1983) developed a powerful technique for spectroscopy of molecular ions using an AC discharge cell, and applied it successfully to the observation of the ν_1 band of HCO^+ and $HN_2{}^+$. In this method, the alternating Doppler shifts of spectral lines due to the drift velocities of molecular ions are used for phase sensitive detection thus discriminating the ion lines from much stronger neutral lines. The existence of a sufficiently large Doppler shift for modulation has been recently demonstrated in a DC discharge. The authors report the application of this method to the observation of the triply degenerate ν_3 fundamental vibration rotation band of the ammonium ion $NH_4{}^+$. (17 refs.)

117871 The ν_3 vibrational spectrum of the free ammonium ion ($NH_4{}^+$). E.Schafer, M.H.Begemann, C.S.Gudeman, R.J.Saykally (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
J. Chem. Phys. (USA), vol.79, no.6, p.3159-60 (15 Sept. 1983).
The authors report the report the first observation of high resolution spectra of $NH_4{}^+$, and give the results of a preliminary analysis of the ν_3 vibrational mode, studied near 3.0 μm with a color center laser spectrometer using the technique of velocity modulated absorption spectropscopy, which they have recently employed for the study of HCO^+, HNN^+, and H_3O^+. (13 refs.)

117872 Study of hydrogen bonds in carbohydrates from the fine structure of the ν(OH) band. R.G.Zhbankov, D.K.Buslov.
J. Appl. Spectrosc. (USA), vol.38, no.1, p.25-32 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.33-41 (Jan. 1983).
The authors used differentiation of IR spectra to study the components of the complex ν(OH) band in carbohydrates (D glucose and cellulose). These increased order spectra clearly showed the fine structure of stretching vibration bands of the hydroxcyl groups included in the hydrogen bonds. (21 refs.)

117873 Collision induced rotational spectrum of allene. W.C.Pringle, S.M.Jacobs, D.H.Rosenblatt (Dept. of Chem., Wesleyan Univ., Middletown, CT, USA).
Mol. Phys. (GB), vol.50, no.1, p.205-15 (Sept. 1983).
The far infrared collision induced absorption spectrum for collisions between allene and allene molecules is presented. The anisotropy and large size of allene is shown to dominate the observed rotational spectrum. Only a small fraction of the observed absorbance results from the leading multipole

moment (quadrupole), uniform field and isotropic polarizability and interaction potential. An upper limit to the quadrupole moment of allene, $\Theta=2.45\times10^{-39}Cm^2$, is determined from the low frequency wing of the collision induced absorption spectrum. The anisotropy of the molecular interaction potential, anisotropic polarizability, overlap distortion, field gradient and multipolar terms following the leading quadrupole are shown to contribute higher frequency absorption. Higher frequency collision induced absorption is also calculated when the multipolar expansion to describe the field is replaced by a model with point charges on the allene nuclei. The implication of the point charge model is that the multipole expansion converges slowly for allene-allene collisions. (23 refs.)

117874 Infrared spectra of N-substituted hydroxamic acids. V.C.Koshy, S.G.Tandon (Dept. of Chem., Ravishankar Univ., Raipur, India).
Natl. Acad. Sci. Lett. (India), vol.5, no.10, p.331-5 (Oct. 1982). [received: Oct. 1983]
IR spectra of 17 N-substituted hydroxamic acids, R. N(OH). C(=O).R′, examined in the region 4000 to 400 cm^{-1}, show three sets of group vibrations (i) hydroxamic acid bands, (ii) aromatic bands, and (iii) skeletal bands. Typical bands due to hydroxamic acid grouping are in the region 3244-3080 cm^{-1} for 2(O-H); 1640-1600 cm^{-1} for ν(C=O); 1340-1300 cm^{1} for ν(C-N) and at 920±20 cm^{-1} for ν(N-O). Aromatic bands appear at the typical positions. Low frequency bands (skeletal) in the region 1290-1255, 810-760, 635-585, 560-530, 525-500, 490-445 and 440-420 cm^{-1} are due to δ'(O-H), δ'(C-N), δ'(N-C=O), w(C=O), δ'(C-C=O), τ(C-N) and δ(C-N-C), respectively. (22 refs.)

117875 Vibrational spectrum of 1,3,5-triamino-2,4,6-trinitrobenzene. T.G.Towns (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
Spectrochim. Acta Part A (GB), vol.39A, no.9, p.801-4 (1983).
The mid-infrared (4000-400 cm^{-1}) spectra in KBr matrix of the title compound (TATB) and four of its isotopic derivatives have been analysed for the purpose of vibrational assignments. The relative simplicity of the spectra, in conjunction with the various isotopic shifts, indicates that thirteen of the seventeen principal spectral features can be attributed to vibrational modes originating in the amino- and nitro-moieties; the remaining four bands to skeletal vibrations. In comparison with spectra of aniline and nitrobenzene, the assignments are consistent with predicted spectral changes due both to hydrogen-bonding and to the presence of canonically electron-withdrawing and electron-donating substituents. (9 refs.)

117876 Evidence of intramolecular hydrogen bonding in a complex *N,N*-disubstituted formamide. R.E.Echols, R.H.Miller, D.Chriss, E.Vessel (Dept. of Chem. & Health Res., Southern Univ., Baton Rouge, LA, USA).
Spectrochim. Acta Part A (GB), vol.39A, no.9, p.805-7 (1983).
Intramolecular hydrogen bonding has been determined to be the controlling factor in the cis-trans isomer ratio in *N*-(2-hydroxy-5-nitrobenzyl)-*N*-(1-methylthio-2-propenyl)formamide. Both ^1H NMR and i.r. show the presence of intramolecular hydrogen bonding in this compound. (8 refs.)

Vibrational spectra of some N-methyl-halogenotriazoles-1,2,4 .... See Entry 117851

Infrared multiphoton excitation of SO_2 to fluorescent states .... See Entry 117903

IR multiple-photon excitation distribution probed by IR fluorescence .... See Entry 117905

Nonradiative relaxation of singlet oxygen in solution .... See Entry 117917

Intensity dependence of CO_2-laser-induced multiphoton absorption and decomposition of monomethylamine .... See Entry 117946

Spectral characteristics of the excitation of SF_6 molecules by an intense infrared laser field under strong cooling conditions .... See Entry 117949

Role of cations in the conformation of iota and kappa carrageenan .... See Entry 118006

The effect of substituents at benzoic ring on the parameters of cholesteryl benzoates infrared spectra in phase transitions .... See Entry 120077

The vibrational spectrum of anisole .... See Entry 120092

Infrared emissions in the CO_2-laser-induced photolysis of trifluoromethane-*d* and mixtures of trifluoromethane-*d* and -*h* .... See Entry 120649

Investigation of some products of photolysis of aqueous solutions of GMP .... See Entry 120663

Stratospheric temperature profile from balloon-borne measurements of the 10.4-μm band of CO_2 .... See Entry 121397

33.20F Raman and Rayleigh spectra

(inc. scattering)

117877 Double resonance excitation of fluorescence by stimulated Raman scattering. S.H.Lee, D.C.Nguyen, J.C.Wright (Dept. of Chem., Univ. of Wisconsin, Madison, WI, USA).
Appl. Spectrosc. (USA), vol.37, no.5, p.472-4 (Sept.-Oct. 1983).
The authors report the results of an experiment that tests the feasibility of double resonance excitation of fluorescence by stimulated Raman scattering. The method is limited by a strong, interfering two-photon process. (6 refs.)

117878 Raman spectroscopic studies on the vibrational relaxation of benzonitrile in benzene solution. H.Abramczyk (Inst. of Appl. Radiation Chem., Tech. Univ., Lodz, Poland).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.287-91 (9 Sept. 1983).
Linewidths of isotropic Raman bands of benzonitrile at 2223 and 452 cm^{-1} were measured as a function of concentration in benzene solution. Experimental results have been compared with those calculated on the basis of the Fischer-Laubereau binary-collision dephasing model and the Knapp-Fischer concentration-fluctuation model. The dephasing model with a purely repulsive potential reproduces the experimental data for both bands. (18 refs.)

117879 Raman spectra of araliphatic peroxides. I.P.Zyat'kov, D.I.Sagaidak, G.A.Pitsevich, V.I.Gogolinskii, N.M.Ksenofontova.
J. Appl. Spectrosc. (USA), vol.38, no.1, p.94-101 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.110-20 (Jan. 1983).
The authors have obtained and studied the Raman spectra of ten diacyl peroxides of an araliphatic series with the general formula RC(O)OOC(O)PhR′, where the R and R′ groups for the respective compounds are: (I) $R=CH_3$, R′=n-I; (II) $R=CH_3$, R′=H; (III) $R=CH_3$, R′=n-O (IV) $R=Ch_3$, R′=n-Cl; (V) $R=CH_3$, R′=n-Br; (VI) $R=CH_3$, $R'=n\text{-}CH_3$; (VII) $R=CH_3\text{-}(CH_2)_2$, R′=H; (VIII) $R=CH_3$, R′=m-Cl; (IX) $R=CH_3$, R′=m-F; (X) $R=CH_3$, $R'=m\text{-}NO_2$. Vibration analyses have been performed. (13 refs.)

117880 Depolarized Rayleigh scattering—temperature dependence of molecular reorientation of CO_2 at constant density. H.Versmold, U.Zimmermann (Phys. Chem., Univ. Dortmund, Dortmund, Germany).
Mol. Phys. (GB), vol.50, no.1, p.65-75 (Sept. 1983).
Depolarized Rayleigh scattering experiments at two constant densities, 0.47 ρ_c and 1.9 ρ_c (ρ_c=critical density), have been carried out in the temperature range 25°C to 150°C. From the spectra, orientational correlation and memory functions are calculated, which are compared with corresponding correlation functions of the J-diffusion model, of the mean squared torque approximation, and of recent molecular dynamics investigations. It is found that the J-diffusion collision parameter β^* as well as the mean squared torque factor $\langle N^2\rangle/4(kT)^2$ decrease with increasing temperature at constant density. Further, at the density $1.9\rho_c$ the J-diffusion model fails to account for the short time dynamics. At this density the memory function shows a shallow negative minimum which is related to a reversal of the angular velocity of the CO_2 molecules in the dense fluid state. This highly damped librational motion gets less pronounced with increasing temperature at constant density. (35 refs.)

Vibrational spectra of some aminonitrotoluenes .... See Entry 117868

Matrix-isolation spectroscopy of Pb_2 .... See Entry 117914

The vibrational spectrum of anisole .... See Entry 120092

Indirect determination of oxidant concentration using resonance Raman spectra of dyes .... See Entry 120692

33.20K Visible spectra

117881 Absorption spectrum of the carbon tetrachloride molecular cation in noble-gas matrices. L.Andrews, B.J.Kelsall, J.H.Miller, B.W.Keelan (Chem. Dept., Univ. of Virginia, Charlottesville, VA, USA).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1417-24 (Sept. 1983).
Carbon tetrachloride diluted in argon, krypton or xenon and subjected to vacuum-ultraviolet radiation during and after condensation gave strong photosensitive absorptions at 425, 430 and 455 nm, respectively, which are assigned to CCl_4^+. This study suggests that absorptions in this region following radiolysis of CCl_4 in hydrocarbon glasses are probably due to CCl_4^+ as well and that structural relaxation follows ionization of CCl_4 in the solid phase. (27 refs.)

117882 Rydberg transitions in the bichromophoric molecules tetramethyl-1, 3-cyclobutanedithione (TMCBDT) and tetramethyl-3-thiocyclobutan-1-one (TMTCB). I.Trabjerg (Dept. of Phys. Chem., H.C. Orsted Inst., Copenhagen, Denmark), M.Vala, J.Baiardo.
Mol. Phys. (GB), vol.50, no.1, p.193-203 (Sept. 1983).
The vacuum ultraviolet spectra of tetramethyl-1, 3-cyclobutanedithione (TMCBDT) and tetramethyl-3-thio-cyclobutan-1-one (TMTCB) in the 140-240 nm range are reported. Each spectrum is analysed and shown to consist of various Rydberg series. While transitions from the non-bonding orbital on the C=S to ns_S, np_S and nd_S Rydberg orbitals dominate the spectra of both compounds, a short series assigned to the non-bonding C=O to ns_O orbitals is observed in TMTCB. The splitting of the n orbitals in TMCBDT is considerably smaller than that in TMTCB or TMCBD. The difference in the n orbital splitting in the two symmetrical molecules, TMCBD and TMCBDT, is attributed to the difference between the orbital energy spacings (n_{CS} or n_{CS}) and the closest-lying σ relay orbital responsible for the through bond interaction. The large splitting in TMTCB is due to the difference in ionization potential between sulphur and oxygen. For this same reason the two highest occupied orbitals in TMCBDT fit into the conventional concept of non-bonding orbitals localized on the heteroatom. In TMCBD the non-bonding orbitals are shown to be ring orbitals with some oxygen p character mixed in. (24 refs.)

Infrared multiphoton excitation of SO_2 to fluorescent states .... See Entry 117903

Electronic spectroscopy of fluorobenzene Van der Waals molecules by resonant two-photon ionization .... See Entry 117935

Optical absorption, electron spin resonance, and electron spin echo studies of the photionization of tetramethylbenzidene in cationic and anionic synthetic vesiscles: comparison with analogous micellar systems .... See Entry 117938

Determination of the relaxation time of the 103 H_2O vibration with an optoacoustic spectrometer and a ruby laser .... See Entry 117973

The vibrational spectrum of anisole .... See Entry 120092

S_1 absorption of chlorophyll-a in the red region .... See Entry 120808

The emission spectrum of yttrium monoxide: new rotational and vibrational results on the $A^2\Pi\text{-}X^2\Sigma^+$ system .... See Entry 121524

33.20L Ultraviolet spectra

117883 Target factor analysis of the ultraviolet spectra of unresolved liquid chromatographic fractions. M.McCue, E.R.Malinowski (Dept. of Chem., Stevens Inst. of Technol., Hoboken, NJ, USA).
Appl. Spectrosc. (USA), vol.37, no.5, p.463-9 (Sept.-Oct. 1983).
Target factor analysis error criteria are applied to the UV spectra of unresolved liquid chromatographic fractions. The method is used not only to determine the number of components contributing to an unresolved chromatographic peak but also to individually verify the presence of suspected components without requiring any knowledge of the other components. An actual experimental example is presented using mixtures of *o*-xylene, ethylbenzene, and *p*-xylene. Factor analysis criteria are used to indicate which one of the fractions contains a UV-absorbing impurity(ies). (11 refs.)

117884 Electronic absorption spectrum of 2-amino-4-methyl pyrimidine in vapour phase. S.P.Gupta, S.K.Sharma (Dept. of Chem., DN Coll., Meerut, India), R.K.Goel.
Acta Phys. Pol. A (Poland), vol.A64, no.3, p.335-40 (Sept. 1983).
The ultraviolet absorption spectrum of 2-amino-4-methyl pyrimidine has been observed in the vapour phase. Two electronic band systems due to $n\text{-}\Pi^*$ and $\Pi\text{-}\Pi^*$ transitions have been observed corresponding to 3200 and 2430 Å systems of pyrimidine respectively. The observed fundamentals and their assignments are reported and discussed. (14 refs.)

117885 Ultraviolet and mass spectra of Schiff bases derived from 4,4-dimethyl-3-oxo-valeraldehyde, acetylacetone and benzoylacetone. A.A.H.Saeed, A.W.A.Sultan, S.A.Selman, N.A.Abood (Dept. of The Coll. of Sci., Basrah Univ., Basrah, Iraq).
Can. J. Spectrosc. (Canada), vol.28, no.3, p.104-5 (1983).
Ultraviolet data are reported for 4,4-dimethyl-3-oxo-valeralydienecyclohexylamine. In addition the mass spectra of Schiff bases derived from 4,4-dimethyl-3-oxo-valeraldehyde, acetylacetone and benzoylace-

tone and aromatic amines have been measured and interpreted in terms of ketamine-enolimine tautomers. (15 refs.)

117886 Rotational perturbations in the CN($B^2\Sigma^+$-$X^2\Sigma^+$) tail band system. II. Identification of the CN($^4\Pi$) state and its vibrational levels. Y.Ozaki, H.Ito, K.Suzuki, T.Kondow, K.Kuchitsu (Dept. of Chem., Univ. of Tokyo, Tokyo, Japan).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.85-94 (Oct. 1983).
For pt.I see ibid., vol.80, p.73 (1983). The intensity anomalies observed in the 12-12 (N=10), 14-14 (N=7, 10) and 17-14 (N=17, 19) lines of the CN violet bands are found to be due to rotational perturbations by the CN($^4\Pi$) state. Experimental evidence that the perturbing state is $^4\Pi$, predicted theoretically by Schaefer and Heil (1971), is presented, and the spectroscopic constants of this state are estimated. (22 refs.)

117887 Abnormal behaviour in the evolution of the UV spectra of parafluorophenylacetic acid as a function of pH. D.Denis-Courtois, B.Vidal (Lab. de Spectroscopie de la Reactivite Chimique, Univ. des Sci. et Tech. de Lille, Villeneuve d'Ascq, France).
J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.6, p.559-61 (June 1983). In French.
The spectrum of parafluorophenylacetic acid shows anomalous behaviour towards pH=3.95. The molecular absorption coefficient ϵ_{00} decreases strongly although the intensity of the whole transition remains a constant. This phenomenon can be explained on the ground of a widening of the transition for a given interaction with the solvent. (14 refs.)

Electronic and infrared spectra of iodoline ....See Entry 117864

Rydberg transitions in the bichromophoric molecules tetramethyl-1, 3-cyclobutanedithione (TMCBDT) and tetramethyl-3-thiocyclobutan-1-one (TMTCB) ....See Entry 117882

Infrared multiphoton excitation of SO_2 to fluorescent states ....See Entry 117903

Electronic spectroscopy of fluorobenzene Van der Waals molecules by resonant two-photon ionization ....See Entry 117935

The vibrational spectrum of anisole ....See Entry 120092

33.20N Vacuum ultraviolet spectra

Investigation of some products of photolysis of aqueous solutions of GMP ....See Entry 120663

33.25 NUCLEAR MAGNETIC RESONANCE AND RELAXATION; NUCLEAR QUADRUPOLE RESONANCE (NQR)

117888 Nuclear magnetic resonance relaxation investigation of tetrahydrofuran and methyl iodide clathrates. M.Junio, D.O.Leicht, M.D.Zeidler (Inst. fur Phys. Chem., RWTH Aachen, Aachen, Germany).
Faraday Symp. Chem. Soc. (GB), no.17, p.25-30 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
Proton and deuteron spin-lattice relaxation rates of the guest molecules have been measured as a function of temperature in methyl iodide and tetrahydrofuran clathrates. By use of the isotopic-dilution method in proton NMR, i.e. employing the compounds $(CH_3I)_x.(CD_3I)_{1-x}.17D_2O$ and $(C_4H_8O)_x.(C_4D_8O)_{1-x}.17D_2O$ with varying mole fractions x, intramolecular and intermolecular contributions to the proton relaxation rate may be separated. Deuteron relaxation rates have been measured in the compounds $CD_3I.17H_2O$ and $C_4D_8O.17H_2O$. The maximum temperature range covered was 0 to −120°C. The proton relaxation rates contain rather large intermolecular contributions, ca. 45% for methyl iodide and 23% for tetrahydrofuran. The correlation times obtained from the intramolecular contributions lie in the range 1-12 and 0.5-1 ps for methyl iodide and tetrahydrofuran, respectively, which is the range typical for liquids. This confirms the well known fact that the enclathrated guest molecules move very fast. The evaluation of the deuteron relaxation rates leads to correlation times which are comparable to those derived from the intramolecular proton rate for tetrahydrofuran, but differ in the case of methyl iodide. This indicates anisotropic rotational motion of the methyl iodide molecule in the clathrate cage. (11 refs.)

117889 NMR spectra of porphyrins. XXI. Applications of the ring-current model to porphyrin and chlorophyll aggregation. R.J.Abraham, K.M.Smith (Robert Robinson Labs., Univ. of Liverpool, Liverpool, England).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5734-41 (7 Sept. 1983).
For pt.XX, see Org. Mag. Reson., vol.19, p.204 (1982). A program incorporating double dipole model of the macrocyclic ring current in the porphyrin and chlorin ring is presented which allows the geometry of the aggregated species in solution to be obtained from observed NMR aggregation shifts. The model is capable of handling dimeric or oligomeric aggregates with either head-to-head or head-to-tail structures; also, one porphyrin may be rotated with respect to the other. Side chains may be rotated separately. The application of the model to a variety of previously recorded aggregates is presented. In the porphyrin series, the refined model allows a more rigorous search procedure than hitherto, and this shows that the structure of the dimers of zinc(II) meso-nitrooctaethylporphyrin and zinc(II), α-β-meso-dinitrooctaethylporphyrin are more similar than was previously recognized. In both structures the coordination is between the zinc atom and the most electron-rich pyrrole subunit of the adjacent molecule. The aggregation shifts of zinc(II) 2-vinylphylloerythrin methyl ester were analyzed and shown to agree with both a centrosymmetric and a twofold symmetric dimer structure. The latter allows maximum interations between the electron-rich and electron-deficient rings and is preferred. In neither case is there any evidence of interaction between the metal and side-chain donor groups. Application of the model to the published aggregation shifts of chlorophyll a and chlorophyll b provides the first quantitative explanation of these aggregation shifts and defines new structures for the aggregates. (31 refs.)

117890 A proton nuclear magnetic resonance study of purine and pyrimidine nucleoside 5′-diphosphates. Extent of macrochelete formation in monomeric metal ion complexes and promotion of self-stacking by metal ions. K.H.Scheller, H.Siegel (Inst. of Inorganic Chem., Univ. of Basel, Basel, Switzerland).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5891-900 (7 Sept. 1983).
The concentration dependence of the chemical shifts for protons H-2, H-8, H-1′ of ADP^{3-} and IDP^{3-}, H-8 and H-1′ of GDP^{3-}, and H-5, H-6, and H-1′ of CDP^{3-} and UDP^{3-} has been measured in D_2O at 27°C. The results are consistent with the isodesmic model of indefinite noncooperative stacking. The association constants for the nucleoside 5′-diphosphates (NDP^{3-}) are between 1.8 (ADP^{3-}) and about 0.6 M^{-1} (UDP^{3-}). The self-stacking tendency of the base moieties of the nucleic acids decreases in the series adenine>guanine≳hypoxanthine>cytosine~uracil. Due to the repulsion of the negatively charged phosphate moieties, self-association is always less pronounced for NDP^{3-} compared to that of the corresponding nucleoside. The self-stacking tendency of NDP^{3-} systems is promoted by a factor of about 2-3 by coordination of Mg^{2+} to the phosphate moiety, which neutralizes part of the negative charge. However, the self-association tendency of $Zn(ADP)^-$ and $Cd(ADP)^-$ or $Zn(IDP)^-$ and $Cd(IDP)^-$ is much larger than that of $Mg(ADP)^-$ or $Mg(IDP)^-$; this is explained by an increased tendency to form an intermolecular metal ion bridge in the dimeric stacks in which Zn^{2+} or Cd^{2+} is coordinated to the phosphate moiety of one NDP^{3-} and to N-7 of the purine residue of the other NDP^{3-}. The shifts of H-8 (and H-2) for complete stacking (δ_∞) agree with this interpretation. Comparison of H-8 at infinite dilution (δ_0) for several systems reveals that an M^{2+}-N-7 interaction exists in the monomeric Zn^{2+} and Cd^{2+} complexes of the purine nucleoside 5′-diphosphates; i.e. a macrochelate is formed through an intramolecular coordination of the metal ion to the phosphate moiety and to N-7. (60 refs.)

117891 Dynamic NMR study of conjugation in tert-butyl thiolformate. E.A.Noe, T.Sanders, F.Badelle, L.Douyon (Dept. of Chem., Jackson State Univ., Jackson, MS, USA).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5918-20 (7 Sept. 1983).
The authors describe a dynamic NMR study of tert-butyl thiolformate; comparison of the results with the barriers for tert-butyl formate provides information about the relative conjugating abilities of oxygen and sulfur, with the formyl group as π-acceptor. The room-temperature NMR spectrum (90.02 MHz) in acetone-d_6 shows a single peak for the formyl proton at δ 10.22. At lower temperatures, the peak broadens and splits into two lines at δ0.99 and 10.17, with populations of 0.18 and 0.82, respectively, at −105°C. A free-energy difference at −105°C of 0.51 kcal/mol was calculated from the relationship $\Delta G° = -RT\ln K$, and populations of 0.20 and 0.80 were estimated at the coalescence temperature (−87°C), assuming that $\Delta G°$ does not change with temperature. (25 refs.)

117892 Measurement of the rotational barrier of a tetraalkylhydrazine radical cation. S.F.Nelsen, G.T.Cunkle, D.H.Evans (Dept. of Chem., Univ. of Wisconsin, Madison, WI, USA).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5928-9 (7 Sept. 1983).
Heteratom-substituted radicals are resonance stabilized by donation of a lone-pair electron to the radical center. The authors report the measurement of the barrier to rotation in a tetraalkylhydrazine radical. (13 refs.)

117893 Solute-solvent interactions: nuclear relaxation of nitric oxide solutions in perfluoro solvents. M.-J.Stebe, G.Serratrice, J.-J.Delpuech (Lab. de Chimie Phys. Organique, Faculte des Sci., Univ. de Nancy I, Vandoeuvre Les Nancy, France).
J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.6, p.547-51 (June 1983). In French.
Nuclear relaxation times are measured in paramagnetic solutions of nitric oxide in various perfluorocarbons. The authors' results confirm the necessity for considering three classes of solvents: aliphatic, cyclic and aromatic. (C_7F_{16}, $C_6F_{11}CF_3$, $CF_3N(CF_2)_4CF_2$, $CF_3N(CF_2)_2OCF_2CF_2$, C_6F_6 and C_6H_6.) The paramagnetic relaxation rates induced by NO molecules are found to be much smaller than expected on the basis of their static magnetic susceptibility (as compared to that of O_2 molecules). This is due to a strong coupling of electronic spin and angular momentum along the line joining the nuclei, themselves coupled to the rotational momentum of the molecule, thus resulting in a considerable reduction of the effective paramagnetic moment of NO molecules. Moreover the reduction is dependent on the reorientation rate of NO molecules and is expected to be larger in aliphatic than in aromatic fluorocarbons due to the presence of larger cavities in the former solvents. Effectively, the magnitude of paramagnetic relaxation rates, although very small, is quite dependent upon the solvent considered, in the expected sequences (aliphatic<cyclic<aromatic). (17 refs.)

117894 Comparative structural study by dipole moments and NMR (^{1}H, 250 MHz) of dimethyl-6,6-cycloundecanones of carbon, silicon and germanium. P.Mazerolles, A.Faucher (Lab. des Organometalliques, Univ. Paul Sabatier, Toulouse, France), P.Mauret, J.-P.Faye, D.Mermillod-Blardet.
J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.6, p.553-7 (June 1983). In French.
The conformations of 6,6-dimethyl 6-sila (and 6-germa) cycloundecanones and of the corresponding carbon cyclanone were studied, using 250 MHz NMR and dipole moment measurements in solution at 25°C. The synthesis of 6,6-dimethyl-cycloundecanone, a new compound, was carried out in seven steps, starting from dimethylglutaric acid. The nature of the heteroatom has no noticeable influence on the conformational equilibrium. The possibility to have in solution conformations in which the C=0 group is partially directed inside the ring is in good agreement with the position almost perpendicular with respect to the average plane of the molecule, which is observed, in solid state, for the germanium derivative. (11 refs.)

117895 Finite-field many-body perturbation theory of the Fermi contact nuclear-spin coupling. M.Iwai, A.Saika (Dept. of Chem., Kyoto Univ., Kyoto, Japan).
Phys. Rev. A (USA), vol.28, no.4, p.1924-9 (Oct. 1983).
The Fermi contact term of the nuclear-spin-spin coupling in the HD molecule is calculated using finite-field many-body perturbation theory (FF MBPT). The one-electron states are generated by the Hartree-Fock potential in the presence of the Fermi contact interaction. The procedure through third order in electron correlation gives a value for the Fermi contact term of 37.2 Hz in fair agreement with the best estimated value of 40.0 Hz at the equilibrium internuclear distance. The result suggests that the FF MBPT approach provides a highly efficient and systematic method for the calculation of the Fermi contact term. A possible origin of the general overestimate by the coupled Hartree-Fock method is also discussed. (26 refs.)

117896 Investigations on the electronic flow of organyl ligands. V. The substituent relations of the coupling constants $^1J(^{199}Hg$-$^{13}C)$ of mercury organyl compound and the hybridisation concept. R.Radeglia (Zentralinst. fur Phys. Chem., Akad. der Wissenschaften, Berlin, Germany), D.Steinborn, R.Taube.
Spectrochim. Acta Part A (GB), vol.39A, no.9, p.843-5 (1983).
For pt.IV see J. Organomet. Chem., vol.234, p.277 (1982). In diorganyl mercury compounds R'-Hg-R'' the ratio of the ^1J(Hg-C) coupling constants of the unsymmetric substituted compounds and the corresponding symmetric compounds HgR'_2 and HgR''_2, respectively, can be interpreted with the Fermi contact term on the basis of the simple hybrid orbital model. Occurring deviations have been diminished using an empiric term which depends only on the coupling constants of the symmetric compounds. (12 refs.)

On the assignment of the HOMO in UF_6 ....See Entry 117761

Finite perturbation MCSCF and CI calculations of nuclear spin-spin coupling constants for some molecules with multiple bonds ....See Entry 117763

Calculation of solvent and internal rotation effects on $^3J_{FH}$ and $^3J_{HH}$ spin-spin coupling constants in 1,2-difluoroethane ....See Entry 117783

Some INDO parameterised MO calculations of cobalt nuclear shielding in some diamagnetic hexacoordinate cobalt(III) complexes ....See Entry 117784

Infrared and nuclear magnetic resonance studies pertaining to the cage model for solutions of acetone in water ....See Entry 117867

Evidence of intramolecular hydrogen bonding in a complex *N,N*-disubstituted formamide ....See Entry 117876

Spin relaxation in the phosphorescent triplet state of several pyridyl carbonyl compounds ....See Entry 117900

Investigation of particularities found in intermolecular interaction for glycerine solutions with ordinary and heavy water through acoustic methods ....See Entry 117951

Conformation of N-substituted heterocycles with an endocyclic amide group. The effect of allylic strain ....See Entry 118005

^{13}C NMR of crystalline morphine ....See Entry 119923

Application of proton NMR spectral editing techniques for selective observation of N-H protons in an actinomycin D complex with a tetranucleotide duplex ....See Entry 120809

33.30 ELECTRON PARAMAGNETIC RESONANCE AND RELAXATION

117897 Trigonal-^{13}C hyperfine coupling in CF_3CCl_2. B.W.Walther, F.Williams (Dept. of Chem., Univ. of Tennessee, Knoxville, TN, USA).
J. Chem. Phys. (USA), vol.79, no.6, p.3167-9 (15 Sept. 1983).
If it is well established that the progressive introduction of α-fluorine substituents induces pyramidality at the trigonal carbon in simple alkyl radicals. A corresponding but less-pronounced effect would also be expected for α-chlorine substitution. In comparison with fluorinated alkyl radicals, much less is known about the configurations of α-chloroalkyl radicals, and ^{13}C hyperfine data for this series have hitherto been limited to the CCl_3 radical. The authors report the trigonal-^{13}C coupling for the CF_3CCl_2 radical which shows that the configuration of this radical is nearly planar. (13 refs.)

117898 Electrochemical and ESR studies of 5,6:11,12-bis(dichalcogeno) tetracenes and their cation radicals. M.T.Jones, S.Jansen (Dept. of Chem., Univ. of Missouri, St. Louis, MO, USA), L.A.Acampora, D.J.Sandman.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1159-65 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Electrochemical and ESR studies of the homologous series of 5,6:11, 12-bis(dichalcogeno)tetracene (X=S, Se or Te) and their cation radicals are reported. Each of the neutral compounds displays two reversible one electron oxidation steps in benzonitrile. The potential difference between these two steps is relatively constant through the series. The solution ESR spectral results show a progressive increase in the spectral linewidth of 0.25, 2.5 and 20G, respectively, as one moves through the series S, Se and Te. Observed is a progressive increase in the isotropic g-value. Both phenomena are explained in terms of the increasing spin-orbit interaction as one moves from lighter to the heavier elements. Also observed and reported for the first time is a resolved ESR spectrum of 5,6:11,12-bis(dithio)tetracene cation radical in methylene chloride. A proton hyperfine splitting of 0.553 (±0.004)G which arises from eight magnetically equivalent protons is observed. These results are consistent with the expected charge and spin density distributions obtained from Huckel and McLachlan calculations. The components of the anisotropic g-tensors for TTT^+ and $TSeT^+$ have been measured and are reported. (14 refs.)

Optical absorption, electron spin resonance, and electron spin echo studies of the photionization of tetramethylbenzidene in cationic and anionic synthetic vesiscles: comparison with analogous micellar systems ....See Entry 117938

Investigation of particularities found in intermolecular interaction for glycerine solutions with ordinary and heavy water through acoustic methods ....See Entry 117951

33.35 DOUBLE RESONANCES AND OTHER MULTIPLE RESONANCES

117899 Observation of the $\nu_3 \rightarrow (2\nu_3,A_1)$ band of methane. A.de Martino, R.Frey, F.Pradere (Lab. d'Optique Quantique, Ecole Polytech., Palaiseau, France).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.329-33 (16 Sept. 1983).
Double-resonance spectra were recorded for several rotational sublevels of the $(2\nu_3,A_1)$ vibrational level of methane. The observed vibrational energy is 5968.1 cm^{-1}, in good agreement with local-mode theory. The effective rotational constant for this level was found to be 5.31 cm^{-1}. This unexpectedly high value could involve interactions with lower vibrational levels. (10 refs.)

33.35H MODR and PMDR (microwave optical double resonance and phosphorescence microwave double resonance)

117900 Spin relaxation in the phosphorescent triplet state of several pyridyl carbonyl compounds. S.G.Hilburn, R.K.Power, K.A.Martin, A.M.Nishimura (Dept. of Chem., Westmont Coll., Santa Barbara, CA, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.429-35 (23 Sept. 1983).
Spin relaxation is observed in benzophenone, isomers of benzoylpyridines and dipyridyl ketones. Models are used to describe optically detected echo shapes observed by transient techniques in the phosphorescent triplet state. Framed after the density matrix approach, the echo shapes were found to adequately fit the analytical expressions. Hahn spin echo, Carr-Purcell multiple echo, and rotary echo pulse sequences were used to study the nuclear contribution to the electron spin dephasing and the proximity effect of the nitrogen nuclei to the localized triplet excitation in the carbonyl portion of the molecule. (23 refs.)

33.45 MAGNETO-OPTICAL AND ELECTRO-OPTICAL SPECTRA; DICHROISM

Polarization holography for measuring photoinduced optical anisotropy ....See Entry 118095

Applications of the modulated liquid crystal-linear dichroism (LC-LD) to spectro- and stereo-chemical problems. III ....See Entry 120019

33.45B Zeeman and Stark effects

The effect of a magnetic field on discrete and continuum CS_2 fluorescence ....See Entry 117913

Determination of the dipole moment of thioformaldehyde in the $\tilde{a}\ ^3A_2$ excited state by laser phosphoresence excitation spectroscopy ....See Entry 117915

CW far-infrared lasing in $^{15}NH_3$, Stark resonantly pumped by a CO_2 or N_2O laser ....See Entry 118120

33.50 FLUORESCENCE, PHOSPHORESCENCE; RADIATIONLESS TRANSITIONS (INTERSYSTEM CROSSING, INTERNAL CONVERSION)

117901 Quenching of the fluorescence of substituted benzenes by halomethanes. H.A.Khwaja, G.P.Semeluk, I.Unger (Dept. of Chem., Univ. of New Brunswick, Fredericton, Canada).
Can. J. Chem. (Canada), vol.61, no.9, p.1952-6 (Sept. 1983).
Rate constants, k_q, for the quenching of the singlet state of benzene, toluene, *p*-xylene, fluorobenzene, trifluoromethyl benzene, *p*-bis(trifluoromethyl)benzene, and aniline by CCl_4, CH_3CCl_3, $CHCl_3$, and $CFCl_3$ in the gas phase have been determined. In each instance the quenching is via a charge-transfer complex with the aromatic acting as donor. There is a linear dependence between ln k_q and IP (ionization potential) of the aromatics which supports Klein's model for exciplex formation. The most effective quencher is CCl_4 while the least effective is $CFCl_3$. The most effective donor was aniline while the least effective one was *p*-bis(trisfluoromethyl)benzene. In general, fluorinated aromatics are less effective donors than the corresponding protonated molecules. (22 refs.)

117902 Laser-induced fluorescence detection of OH produced by reaction of hot H atoms with CO_2. C.R.Quick,Jr., J.J.Tiee (Chem. Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.223-6 (9 Sept. 1983).
Laser-induced fluorescence (LIF) detection of OH radicals is used to examine the reaction of CO_2 molecules with translationally hot H atoms generated by ArF laser photolysis of HBr. Prompt formation of rotationally excited OH X $^2\Pi_i(v''=0,1,2)$ has been observed. (21 refs.)

117903 Infrared multiphoton excitation of SO_2 to fluorescent states. T.B.Simpson, N.Bloembergen (Gordon McKay Lab., Harvard Univ., Cambridge, MA, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.325-8 (16 Sept. 1983).
SO_2 molecules excited under essentially collision-free conditions by intense (>20 GW/cm^2) CO_2 laser pulses give off a broad UV-visible luminescence through inverse electronic relaxation. Unlike in larger polyatomics, the infrared multiphoton excitation process is controlled by the laser intensity and not the laser fluence. (18 refs.)

117904 Coriolis effects on 'intermediate case' of intramolecular vibrational relaxation: rotational-temperature dependence of energy-resolved fluorescence from jet-cooled perylene with 776-975 cm^{-1} excess energies. B.E.Forch, K.T.Chen, E.C.Lim (Dept. of Chem., Wayne State Univ., Detroit, MI, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.389-92 (23 Sept. 1983).
The rotational-temperature dependence of the energy-resolved fluorescence, combined with the calculated level density, indicates that the large variations in the rate of the intramolecular vibrational relaxation over a small excess energy in S_1 perylene is due to the fluctuations in the density of accessible vibrational levels, resulting from the vibrational selection rules for second-order Coriolis coupling. (8 refs.)

117905 IR multiple-photon excitation distribution probed by IR fluorescence. M.Brestel, A.Yogev (Dept. of Isotope Res., Weizmann Inst. of Sci., Rehovot, Israel).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.408-14 (23 Sept. 1983).
Vibrational fluorescence induced by IR multiple-photon excitation of hexafluorocyclobutene was measured as a function of laser frequencies. The width and shift of the inhomogeneous broadened fluorescence bands represent the excitation energy. The contrasting shapes of the excitation and previously measured chemical yield spectra are explained by the Poisson distribution of the molecules in the quasicontinuum. (18 refs.)

117906 Picosecond fluorescence relaxation kinetics from all-trans retinal. A.G.Doukas, M.R.Junnarkar, D.Chandra, R.R.Alfano, R.H.Callender (Dept. of Phys., City Coll. of New York, New York, NY, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.420-4 (23 Sept. 1983).
The fluorescence relaxation kinetics from all-trans retinal in polar and nonpolar solvents have been investigated as a function of temperature. An activation energy of ≈ 1 kcal/mole has been measured. The results, in conjunction with previous picosecond absorption measurements made by Hochstrasser et al. (1976), strongly suggest that initially excited molecules to Franck-Condon states relax to three singlet excited states. (8 refs.)

117907 Determination of the quenching rates of $N_2^+(B^2\Sigma_u^+, \nu=0,1)$ by N_2 using laser-induced fluorescence. J.Jolly, A.Plain (Lab. de Phys. des Gaz et des Plasmas, Univ. Paris-Sud, Orsay, France).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.425-8 (23 Sept. 1983).
Time-resolved fluorescence laser-induced spectroscopy was used to examine the quenching of the vibrational levels $\nu=0$ and $\nu=1$ of $N_2^+(B^2\Sigma_u^+)$ by N_2. The rate coefficients of the quenching reactions are found to be constant over the temperature range 300-500K. The quenching constant for the $\nu=1$ state was found to be approximately twice the value of the quenching constant of the $v=0$ state. (11 refs.)

117908 Generation of $^1O_2$ from O_2 quenching of the lowest excited singlet and triplet states of 9,10-diphenylanthracene. W.Drews, R.Schmidt, H.-D.Brauer (Inst. for Phys. & Theoretical Chem., Univ. of Frankfurt, Frankfurt/Main, Germany).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.466-9 (23 Sept. 1983).
Measurements of the quantum yield for photoperoxidation of 9,10-diphenylanthracene as a function of dissolved oxygen concentration in toluene at 20°C, are consistent with generation of $^1O_2$ from both the lowest singlet and triplet states of the hydrocarbon. (27 refs.)

117909 Comments on 'Generation of $^1O_2$ and the mechanism of internal conversion in 9,10-diphenylanthracene'. H.-D.Brauer, R.Schmidt (Inst. for Phys. & Theoretical Chem., Univ. of Frankfurt, Frankfurt/Main, Germany).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.470-1 (23 Sept. 1983).
For original paper see A.P. Darmanyan, ibid., vol.91, p.396 (1982). The authors comment on Darmanyan's paper concerning the generation of $^1O_2$ by 9,10-diphenylanthracene (DPA) where channels for the quenching of the S_1 and T_1 states of DPA by oxygen were considered. They point out that one of the expressions derived by Darmanyan is incorrect. (3 refs.)

117910 Generation of $^1O_2$ by 9,10-diphenylanthracene. A.P.Darmanyan (Inst. of Chem. Phys., Acad. of Sci., Moscow, USSR).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.472-4 (23 Sept. 1983).
The author comments on previous papers by himself (ibid., vol.91, p.396 (1982)) and Drews et al. (ibid., vol.100, p.466 (1982)) on the quenching of excited singlet (S_1*) and triplet (T) states of 9,10-diphenylanthracene by $^3O_2$ with the generation of $^1O_2$. (17 refs.)

117911 The heavy atom effect in the room temperature luminescence of some pesticides and ecologically related compounds. G.F.Kirkbright, A.E.S.Shaw (Dept. of Instrumentation, Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
Can. J. Spectrosc. (Canada), vol.28, no.3, p.100-3 (1983).
Studies are described in which the luminescence characteristics of some pesticides and biphenyl compounds, at the submicrogram level, were examined, with particular reference to improvement of detection limits by utilisation of the heavy atom (HA) effect and to measurement of room temperature phosphorescence (RTP) of samples deposited on filter paper. (15 refs.)

117912 The theory of transitions between electronic states. Application to radiation transitions in polar solvents. L.D.Zusman (Inst. of Inorganic Chem., Acad. of Sci., Novosibirsk, USSR).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.29-43 (Oct. 1983).
In this work the theory of transitions between electronic states is developed. In the limiting cases of weak and strong interactions the analytical results for the full rates of transitions are found. It is shown that in the case of strong interactions the result for the rates of transition is independent of the specific form of partial rates and its form is determined fully by the principle of detailed balance. Using the Pade approximation, the expression for the full rate of transition is found in the case of interactions of mediate strength. The theory is applied to the description of radiationless transitions in polar solvents. (31 refs.)

117913 The effect of a magnetic field on discrete and continuum CS_2 fluorescence. S.J.Silvers, M.R.McKeever, G.K.Chawla (Dept. of Chem., Virginia Commonwealth Univ., Richmond, VA, USA).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.177-82 (Oct. 1983).
The fluorescence of CS_2 vapor, excited by a nitrogen laser, consists of discrete bands superimposed upon an apparent continuum. The bands are progressions from an initially excited T^1A_2 vibronic level, while the continuum appears to arise subsequent to collisional and possibly intramolecular relaxation processes. Here it is seen that an 18 kG magnetic field quenches 75% of the discrete fluorescence, but that the discrete lifetime is unaffected. This discrete quenching is interpreted as Zeeman detuning of the exciting and absorbing lines. Also, the continuum is partially quenched by the 18 kG field. At 340 mTorr 20% of the continuum fluorescence is quenched. The present quenched decreases with decreasing CS_2 pressure. Below 25 mTorr no continuum quenching is observed. The field reduces the rate at which collisions enhance continuum formation. (13 refs.)

117914 Matrix-isolation spectroscopy of Pb_2. H.Sontag, B.Eberle, R.Weber (Fakultat for Phys., Univ. Konstanz, Konstanz, Germany).
Chem. Phys. (Netherlands), vol.80, no.3, p.279-88 (15 Oct. 1983).
Fluorescence and Raman scattering were observed from Pb_2 isolated in neon and argon matrices. Two new excited states were observed by two-photon stepwise excitations, which involve low-lying electronic states of Pb_2. Most spectroscopic constants of the states observed could be given and complement previous results. Two resonance Raman progressions with $\omega_e = 112.5$ and 123.1 cm^{-1} and a single Raman signal at 80 cm^{-1} were observed in argon matrices. The $\omega_e = 123.1$ cm^{-1} Raman signal which had recently been assigned to a larger Pb cluster was shown to arise from Raman scattering within the electronically excited A state of Pb_2 at ≈ 5550 cm^{-1}. (16 refs.)

117915 Determination of the dipole moment of thioformaldehyde in the $\tilde{a}$ $^3A_2$ excited state by laser phosphoresence excitation spectroscopy. D.J.Clouthier, C.M.L.Kerr (Herzberg Inst. of Astrophys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Chem. Phys. (Netherlands), vol.80, no.3, p.299-304 (15 Oct. 1983).
Doppler-limited phosphorescence excitation spectra have been recorded at various electronic fields for two rotational transitions in the $\tilde{a}^3A_2$-$\tilde{X}^1A_1$ 0-0 bands of H_2CS. Stark splittings were resolved, and were used to determine the dipole moment in the excited electronic state. The value found, 0.57(3) D, is of the order expected by comparison with dipole moments determined for other states of H_2CS, but rather lower than that predicted by ab initio calculations. (18 refs.)

117916 On the nature of the fluorescent state of methylated indole derivatives. S.R.Meech, D.Phillips (Davy Faraday Lab., Royal Instn., London, England), A.G.Lee.
Chem. Phys. (Netherlands), vol.80, no.3, p.317-28 (15 Oct. 1983).
A quantitative study has been made of the solvent effects on the fluorescence properties of 1- and 3-methyl indole, with the aim of further understanding the origin of the unusually large Stokes shift in polar solvents. For the derivatives considered, the fluorescence transition probability is decreased in solvents of moderate and high polarities, and the spectrum shifts to the red. The data (n two-component, solute and solvent, systems) can be interpreted on the basis of the stabilisation, by solvent-solute relaxation, of a state with an increased charge-transfer character, relative to the initially excited state. A consideration of the decay data for other indole derivatives suggests that this state has its origin in the ^1L_a state (S_2 in nonpolar media). Thus the authors conclude that the appropriate label of the fluorescent state of many substituted indoles in polar solvents is ^1L_a/CT. This is consistent with the observed solvent, temperature, time and substituent dependence of the decay kinetics of these derivatives. (48 refs.)

117917 Nonradiative relaxation of singlet oxygen in solution. J.R.Hurst, G.B.Schuster (Dept. of Chem., Univ. of Illinois, IL, USA).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5756-60 (7 Sept. 1983).
The solvent induced nonradiative relaxation of singlet oxygen ($^1O_2$, $^1\Delta_g$) was examined by directly monitoring infrared phosphorescence following pulsed laser generation. The effects of solvent electronic properties, nuclear spin, oxygen isotope, temperature, and magnetic field were examined systematically. The quenching of $^1O_2$ is related to the energy of the solvent highest frequency mode vibration. A relaxation mechanism based on exchange energy transfer is proposed to accommodate the results. An empirical relationship is developed that permits calculation of the $^1O_2$ lifetime in nonreactive organic solvents. (32 refs.)

117918 5f state interaction with inner coordination sphere ligands: Es^{3+} ion fluorescence in aqueous and organic phases. J.V.Beitz, D.W.Wester, C.W.Williams (Argonne Nat. Lab., Argonne, IL, USA).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.331-8 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
The interaction between the 5f electron states of the Es^{3+} ion and coordinated ligands in solution was probed using laser-induced fluorescence. The aquo-Es^{3+} ion was observed to fluoresce from its first excited J=5 state in a broad band peaking at 9260 cm^{-1}. The observed fluorescence liftimes were 1.05 μs and 2.78 μs in H_2O and D_2O (minimum isotopic purity, 99 at.% D) respectively. The non-radiative decay rates derived from the lifetime data are compared with previously reported data for hydrated Cm^{3+}, Sm^{3+}, Eu^{3+}, Tb^{3+} and Dy^{3+} ions. The 5f actinide states exhibit substantially greater non-radiative decay rates than do lanthanide 4f states with a similar energy gap. This provides evidence that actinide 5f electrons interact more strongly with their inner coordination sphere than do lanthanide ion 4f electrons. The fluorescence lifetime of Es^{3+} complexed with 1 formal (1 g formula weight (1 mol.) dissolved in sufficient solvent to give 1 dm^3 of solution) di(2-ethylhexyl)orthophosphoric acid in n-heptane was 2.34 μs. (16 refs.)

117919 Photodissociation dynamics of triatomic molecules—effect of predissociation on diatomic fragment fluorescence polarization. T.Nagata, T.Kondow, K.Kuchitsu (Dept. of Chem., Univ. of Tokyo, Tokyo, Japan), G.W.Loge, R.N.Zare.
Mol. Phys. (GB), vol.50, no.1, p.49-63 (Sept. 1983).
Calculations are presented for the polarization anisotropy, $R=(I_\parallel - I_\perp)/(I_\parallel + 2I_\perp)$, of the fragment fluorescence ($AB^* \rightarrow AB + h\nu$) when a triatomic molecule (ABC) is photodissociatied by a beam of linearly polarized radiation. Expressions are developed relating the polarization anisotropy to the predissociation lifetime τ of the (ABC*) complex under the assumptions that (1) the motion of the (ABC*) complex can be described by the classical motion of the prolate symmetric top, (2) the AB* excited fragment rotates in the plane of the (ABC*) complex at the time of dissociation and (3) the absorption and emission processes can be described by classical hertzian dipole oscillators. The time averaged autocorrelation function of a free symmetric top, $<D_{mm'}^{(2)}(\delta\Omega(t)))$, is used to find $R(\tau)$ for the dissociation of an (ABC*) complex in a single J,K level and for this quantity averaged over a Boltzmann distribution of J,K levels. (24 refs.)

Spectroscopic study of 2-amino-4-cyano-3-phenyl-5-(p-chlorophenyl)-furane in various solvents ....See Entry 117861

Substituent perturbation on masked ^1L_b-$^1A_1$ transition of anthracene monosulphonates: detection by photoselection in glycerol glass at 77K ....See Entry 117862

Double resonance excitation of fluorescence by stimulated Raman scattering ....See Entry 117877

Spin relaxation in the phosphorescent triplet state of several pyridyl carbonyl compounds ....See Entry 117900

Determination of rotational alignment of $N_2{}^+B^2\Sigma_u{}^+$ and $CO^+B^2\Sigma^+$ following photoionization of N_2 and CO ....See Entry 117940

Form of the fluctuation distribution function of fluorescent molecules over electron transition frequencies ....See Entry 120137

The lifetime of the fluorescent excited state of liquid cyclohexane ....See Entry 120145

NO fluorescence during vacuum-ultraviolet photodissociation of $CFCl_2NO$ ....See Entry 120656

Photochemistry and sensitized evolution of hydrogen from water using water-soluble cationic porphyrins. Tetrakis(trimethylaminophenyl)porphyrinatozinc and its free base ....See Entry 120657

Magnetic field effect on the hydrogen abstraction of xanthone from xanthene in SDS micelles ....See Entry 120664

33.65 PHOTOELECTRON SPECTRA

117920 Calculation of vertical ionization potentials of chloroketene and dichloroketene by perturbation corrections to Koopmans' theorem using an effective core potential. S.R.Langhoff (NASA Ames Res. Center, Moffett Field, CA, USA), D.P.Chong.
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.259-62 (9 Sept. 1983).
The relatively economical procedure of the combined use of effective core potentials and perturbation corrections to Koopmans' theorem has been applied to chloroketene and dichloroketene. A clearcut assignment of all the bands in the HeI photoelectron spectra is established. (15 refs.)

117921 Non-Koopmans contributions to the photoelectron spectra of *p*-quinodimethane, 3,7-dimethyl-*p*-quinodimethane and tetracyano-*p*-quinodimethane: a limited CI description. R.W.Bigelow (Xerox Webster Res. Center, Webster, NY, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.445-9 (23 Sept. 1983).
The low-lying doublet states of the *p*-quinodimethane (**1**) 3,7-dimethyl-*p*-quinodimethane (**2**) and tetracyano-*p*-quinodimethane (TCNQ) (**3**) cations are addressed within the semi-empirical open-shell RHF CNDO/S(CI) formalism. Results indicate that the reduced intensity observed experimentally for the third ionization in both **1** and **2** arises from a pronounced configuration mixing between the parent one-electron Koopmans state and the non-Koopmans HOMO→LUMO valence excitation. Similar contributions are found to account for the relative intensities of the first and second ionization bands (1.0:1.425) in **3**. (32 refs.)

117922 Breakdown in the Koopmans' theorem interpretation of the outer valence-level photoemission spectra of selected organic molecules. R.W.Bigelow (Xerox Webster Res. Center, Webster, NY, USA).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.45-62 (Oct. 1983).
Various final-state manifestations arising from a breakdown in a Koopmans' theorem interpretation of the lower-lying valence level photoemission spectra of benzene *p*-quinodimethane, trans-butadiene, *p*-nitroaniline, trans-stilbene and acrolein are addressed within the semi-empirical open-shell RHF CNDO/S(CI) approximation. The results on benzene, trans-butadiene and *p*-quinodimethane support previous interpretations based on experimental and/or theoretical arguments of pronounced many-body interactions for ionizations between 9 and 14 eV. Computations on *p*-nitroaniline indicate an unusually strong breakdown in the one-particle description of photoionization at ≈10.0 eV due to coupling between appropriate primary hole-states and concomitant one-electron excitations to low-lying virtual levels having considerable localization on the nitro group. The open-shell RHF CNDO/S(CI) energy and projected hole-state distributions yield theoretical photoemission spectra for the molecules considered which offer considerable improvement over the Koopmans' theorem assignment. (76 refs.)

117923 The He (I) and He (II) photoelectron spectra of BIS (2,4,6-tri-*t*-butylphenyl)-diphosphene. B.Cetinkaya, M.F.Lappert, J.G.Stamper, R.J.Suffolk (School of Chem. & Molecular Sci., Univ. of Sussex, Brighton, England).
J. Electron Spectrosc. & Relat. Phenom. (Netherlands), vol.32, no.2, p.133-7 (Sept. 1983).
Photoelectron spectra of the title compound have been obtained using various ionising radiations. The bands up to ~10 eV have been assigned with the aid of molecular-orbital calculations. (15 refs.)

117924 He (I) and He (II) photoelectron spectra of glycine and related molecules. P.H.Cannington, N.S.Ham (Div. of Chem. Phys., CSIRO, Clayton, Victoria, Australia).
J. Electron Spectrosc. & Relat. Phenom. (Netherlands), vol.32, no.2, p.139-51 (Sept. 1983).
Photoelectron spectra obtained by He (I) and He (II) excitation of glycine, sarcosine and glycine methyl ester are presented. The *p*-type bands in the He (I) spectrum of glycine are interpreted in terms of localized molecular orbitals; the C 2*s* bands are identified in the He (II) spectrum. He (I) spectra of some *N*-acetylamino acids and of a variety of α- and ω-substituted amino acids and also reported. (29 refs.)

117925 He (I) and He (II) photoelectron investigation of the electronic structure of tropolone and of the related anion ligand. G.Bruno, G.Centineo, E.Ciliberto, I.Fragala (Istituto Dipartimentale di Chimica, Univ. di Catania, Catania, Italy).
J. Electron Spectrosc. & Relat. Phenom. (Netherlands), vol.32, no.2, p.153-62 (Sept. 1983).
He (I) and He (II) photoelectron spectra of gas-phase tropolone, 2-methoxytropone and the thallium (I) tropolonate complex are reported. Comparison with the PE spectra of related molecules as well as with semiempirical quantum-mechanical calculations are used in making assignments. Remarkable analogies are apparent with the spectrum of the parent molecule tropone. Effects due to intramolecular hydrogen bonding account for some details of the tropolone spectrum. Comparison of the PE spectra of neutral tropolone and of its Tl (I) complex leads to a reasonable description of the electronic structure of the tropolonate anion ligand. (27 refs.)

117926 Vacuum ultraviolet photoelectron spectroscopy of transient species. XVI. The NCO($X^2\Pi$) radical. J.M.Dyke, N.Jonathan, A.E.Lewis, J.D.Mills, A.Morris (Dept. of Chem., Univ. of Southampton, Southampton, England).
Mol. Phys. (GB), vol.50, no.1, p.77-89 (Sept. 1983).
The He (I) photoelectron spectrum of the NCO($X^2\Pi$) radical, produced from the gas phase reaction of atomic fluorine with isocyanic acid, has been recorded. Of the thirteen ionic states accessible from the neutral molecule with He (I) radiation, seven have been observed and assigned using the results of ab initio ΔSCF calculations. Evidence is presented to show that the $X^3\Sigma$ NCO^+ potential energy surface is significantly different from those for the $a^1\Delta$ and $b^1\Sigma^+$ ionic states. The first adiabatic ionization potential of NCO is measured as (11.76 ± 0.01) eV and this leads to an estimate of $D_0(N\text{-}CO^+)$ of (4.40 ± 0.16) eV. From the observed spectra predictions are made of possible electronic transition energies in NCO^+. (36 refs.)

117927 The low-lying cationic hole-states of η^3-allyl tetracarbonyl complexes of Mn and Re—photoelectron spectra and Green's function calculations. M.C.Bohm, R.Gleiter (Organisch-Chem. Inst., Univ. Heidelberg, Heidelberg, Germany), T.A.Albright, V.Sriyunyongwat.
Mol. Phys. (GB), vol.50, no.1, p.113-28 (Sept. 1983).
The electronic structure in the ground state and the low-lying cationic hole states in a series of six η^3-allyl transition metal tetracarbonyl complexes with Mn and Re has been studied by means of molecular orbital calculations and by means of He (I) photoelectron spectroscopy. The computational framework is a semiempirical INDO model. The ionization energies are calculated by means of the Green's function formalism with a second order and a renormalized self-energy approximation. Significant differences in the localization properties of the outer valence orbitals lead to a large deviation in the calculated reorganization energies. Koopman's theorem is invalid in the manganese series. The interrelation between simple fragment molecular orbital models for transition metal complexes and the nature of the low-lying hole states is analysed. (44 refs.)

117928 Electronic and magnetic properties of biliverdinate dimethylester metal(II) compounds [M^{II}(BVDME)] (M=Mn^{II}, Co^{II}, Cu^{II}, Zn^{II}). T.Beringhelli, F.Morazzoni, P.Manitto, D.Monti (Univ. di Milano, Milano, Italy).
Spectrochim. Acta Part A (GB), vol.39A, no.9, p.751-9 (1983).
Biliverdinate dimethylester metal(II) compounds, [M^{II}(BVDME)] (M=Mn^{II}, Co^{II}, Cu^{II}, Zn^{II}), have been characterized by their electronic and magnetic properties. ESR parameters of cobalt and copper compounds are in agreement with a planar structure of coordinated biliverdinate dianion, and the ground state configurations of metals are respectively $(xz \text{ or } yz)^2(yz \text{ or } xz)(x^2-y^2)^2(z^2)^2$ and $(xz)^2(yz)^2\,(x^2-y^2)^2(z^2)^2(xy)$. These configurations well explain the presence of a radical species formulated as biliverdinate dimethylester cobalt(III) radical anion, [Co^{III}(BVDME)]$^{\dot{-}}$, beside the corresponding cobalt(II) compound, [Co^{II}(BVDME)]. The preparation method or the interaction with a solvent can make variations in the amount of the radical form [Co^{III}(BVDME)]$^{\dot{-}}$; dilution by [Zn^{II}(BVDME)] or the presence of base donor solvent (pyridine) completely removes the interaction between Co(III) and (BVDME)$^{\dot{-}}$. A comparison between [Co^{II}(BVDME)] and the cobalt oxygen carriers compounds usually employed as models of the heme proteins leads to conclude that [Co^{II}(BVDME)] does not reduce O_2 to O_2^-, probably because the electron transfer to BVDME ligand successfully competes with that to the O_2 molecule. (15 refs.)

Shape resonances in the valence-shell photoionization of cyanogen .... See Entry 117932

Angular distribution for the major photoelectron bands of nitrogen below 45 eV binding energy .... See Entry 117937

33.70 INTENSITIES AND SHAPES OF MOLECULAR SPECTRAL LINES AND BANDS

117929 Radiative lifetime and quenching of SO($b^1\Sigma^+$, $\nu'=0$). J.Wildt, E.H.Fink, R.Winter, F.Zabel (Univ.-Gesamthochschule Wuppertal, Wuppertal, Germany).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.167-75 (Oct. 1983).
Metastable excited SO($b^1\Sigma^+$) radicals were generated by pulse photolysis of SO_2 or $SOCl_2$ using an excimer laser source at 248 nm. Time-resolved measurements of the $b^1\Sigma^+\rightarrow X^3\Sigma^-$ emission yielded a radiative lifetime of $\tau_{rad}=5.7\pm0.8$ ms for the SO($b^1\Sigma^+$, $\nu'=0$) state from which a value of $(5.0\pm0.6)\times10^{-4}$ D^2 is calculated for the square of the transition moment, $|R_e|^2$, of the SO($b^1\Sigma^+\rightarrow X^3\Sigma^-$) transition. Rate coefficients for the quenching of SO($b^1\Sigma^+$, $\nu'=0$) were measured for SO_2, He, Ar, H_2, D_2, N_2, CO, CO_2, and CH_4. The results suggest that in some cases near resonant E→V energy-transfer processes are the major channels in the quenching mechanism. (41 refs.)

Measurement of frequency shifts using infrared or Raman difference spectroscopy .... See Entry 117241

Comment on 'Nonadiabatic treatment of the intensity distribution in the *V-N* bands of ethylene' .... See Entry 117856

Spectroscopic study of 2-amino-4-cyano-3-phenyl-5-(p-chlorophenyl)-furane in various solvents .... See Entry 117861

Vibrational spectrum of 1,3,5-triamino-2,4,6-trinitrobenzene . See Entry 117875

Abnormal behaviour in the evolution of the UV spectra of para-fluorophenylacetic acid as a function of pH .... See Entry 117887

Dynamic NMR study of conjugation in tert-butyl thiolformate .... See Entry 117891

IR multiple-photon excitation distribution probed by IR fluorescence .... See Entry 117905

Picosecond fluorescence relaxation kinetics from all-trans retinal .... See Entry 117906

Determination of the quenching rates of $N_2^+(B^2\Sigma_u^+$, $\nu=0,1)$ by N_2 using laser-induced fluorescence .... See Entry 117907

The heavy atom effect in the room temperature luminescence of some pesticides and ecologically related compounds .... See Entry 117911

The He (I) and He (II) photoelectron spectra of BIS (2,4,6-tri-*t*-butylphenyl)-diphosphene .... See Entry 117923

Proton-stopping power of argon, krypton, and xenon .... See Entry 117965

Core level excitation of simple gases .... See Entry 117995

Energetics of the ionization and fragmentation of phosphorus oxyfluoride studied by electron-impact spectroscopy .... See Entry 117997

Continuous tuning of the frequency of an NH_3 laser within the gain profile .... See Entry 118191

The lifetime of the fluorescent excited state of liquid cyclohexane .... See Entry 120145

Photochemistry and sensitized evolution of hydrogen from water using water-soluble cationic porphyrins. Tetrakis(trimethylaminophenyl)porphyrinatozinc and its free base .... See Entry 120657

33.80 PHOTON INTERACTIONS WITH MOLECULES

Contrasting picosecond photokinetics of Co^{II} and Co^{III} porphyrins verify excited-state predictions .... See Entry 117809

Quasienergetic method in the theory of opticocollisional transitions .... See Entry 117961

33.80B Level crossing and optical pumping

117930 Explicit Hilbert-space representations of atomic and molecular photoabsorption spectra: computational studies of Stieltjes-Tchebycheff functions. M.R.Hermann, P.W.Langhoff (Dept. of Chem., Indiana Univ., Bloomington, IN, USA).
Phys. Rev. A (USA), vol.28, no.4, p.1957-73 (Oct. 1983).
Explicit Hilbert-space techniques are reported for construction of the discrete and continuum Schrodinger states required in atomic and molecular photoexcitation and/or photoionization studies. These developments extend and clarify previously described moment-theory methods for determinations of photoabsorption cross sections from discrete basis-set calculations to include explicit construction of underlying wave functions. The appropriate Stieltjes-Tchebycheff excitation and ionization functions of *n*th order are defined as Radau-type eigenstates of an appropriate operator in an *n*-term Cauchy-Lanczos basis. The energies of these states are the Radau quadrature points of the photoabsorption cross section, and their (reciprocal) norms provide the corresponding quadrature weights. Although finite-order Stieltjes-Tchebycheff functions are L^2 integrable, and do not have asymptotic spatial tails in the continuous spectrum, the Radau quadrature weights nevertheless provide information for normalization in the conventional Dirac δ-function sense. Since one Radau point can be placed anywhere in the spectrum, appropriately normalized convergent approximations to any of the discrete or continuum Schrodinger states are obtained from the development. Connections with matrix partitioning methods are established, demonstrating that *n*th-order Stieltjes-Tchebycheff functions are optical-potential solutions of the matrix Schrodinger equation in the full Cauchy-Lanczos basis. (58 refs.)

A non-van der Waals minimum of the $He(^1S)+H_2(B^1\Sigma_u^+)$ excited surface .... See Entry 117792

Role of coherence in multiquantum excitation of molecules by IR laser radiation .... See Entry 117944

Spectral characteristics of the excitation of SF_6 molecules by an intense infrared laser field under strong cooling conditions .... See Entry 117949

Effects of quantum flux on the relaxation of paired modes of the CO_2 molecule .... See Entry 117972

CW far-infrared lasing in $^{15}NH_3$, Stark resonantly pumped by a CO_2 or N_2O laser .... See Entry 118120

Millimeter wave spectroscopic studies of collision-induced energy transfer processes in the $^{13}CH_3F$ laser .... See Entry 118123

33.80E Autoionization, photoionization, and photodetachment

117931 Double enhancement of the multiphoton ionization of nitric oxide. T.C.Steimle, Huei-Tarng Liou (Chem. Phys. Inst., Univ. of Oregon, Eugene, OR, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.300-4 (9 Sept. 1983).
Resonance-enhanced multiphoton ionization (REMPI) of nitric oxide has been investigated at high resolution. A number of doubly-enhanced transitions have been assigned and their transition frequencies measured. The enhancing states are the A $^2\Sigma$ state and high-lying Rydberg states between 65000 and 67000 cm^{-1} in energy. Two-photon transition strengths for the A $^2\Sigma$-$X^2\Pi$ states were calculated and compared with the high-resolution REMPI spectra. (19 refs.)

117932 Shape resonances in the valence-shell photoionization of cyanogen. J.Kreile, A.Schweig, W.Thiel (Fachbereich Phys. Chem., Univ. Marburg, Marburg, Germany).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.251-7 (16 Sept. 1983).
Vibrationally-resolved photoelectron angular distributions for the first four valence-shell photoionizations of cyanogen have been measured with Ne I, He I and Ne II line sources. Calculated photoionization cross sections and asymmetry parameters are reported for photon energies up to 50 eV. The experimental and theoretical results indicate the presence of several shape resonances. (46 refs.)

117933 The absorption spectrum resonance structure of diatomic molecules near the ionization threshold. G.V.Goloubkov, G.K.Ivanov (Inst. of Chem. Phys., Acad. of Sci., Moscow, USSR).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.358-62 (16 Sept. 1983).
The problem of the near-threshold photoionization of the non-symmetrical molecules XY is formulated in connection with the problem of scattering of the emitted electrons by molecular ions using the integral multichannel quantum defect method and results of the adiabatic approximation. In addition to the general theory, analytical formulae are obtained describing the simplest two-channel cases which demonstrate specific features of interference structure of absorption spectra as well as the role of various factors in the formation of the line profile. (15 refs.)

117934 Two-frequency two-photon ionization of nascent PO($X^2\Pi$) from the collision-free IR photolysis of dimethyl methylphosphonate. J.S.Chou, D.Sumida, C.Wittig (Dept. of Chem., Univ. of Southern California, Los Angeles, CA, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.397-402 (23 Sept. 1983).
The authors report the detection of nascent PO produced via the collision-free IR photolysis of dimethyl methylphosphonate. Absorption throughout the $B^2\Sigma^+ \leftarrow X^2\Pi$ system is followed by excitation using 266 nm radiation, which results in $PO^+ + e$. Spectral features due to spin-orbit excitation appear extremely 'cold' relative to vibrations and rotations. (18 refs.)

117935 Electronic spectroscopy of fluorobenzene Van der Waals molecules by resonant two-photon ionization. K.Rademann, B.Brutschy, H.Baumgartel (Inst. fur Phys. Chem., Freien Univ. Berlin, Berlin, Germany).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.129-45 (Oct. 1983).
Van der Waals (vdW) clusters of fluorobenzene (FB), synthesized in a seeded supersonic rare-gas expansion were studied by laser-induced, resonant two-photon ionization (R2PI) combined with TOF mass spectrometry. The molecules were excited near the FB monomer's vibronic origin of the $S_1(\pi\pi^*) \leftarrow S_0$ transition ($\lambda_{00}=2644$ Å). The heterogeneous clusters $FB.Ar_n$ ($n<4$) showed specific shifts of the 0-0 band relative to λ_{00} induced by vdW interaction (FB.Ar: -23 cm^{-1}; $FB.Ar_2$: -46 cm^{-1}; $FB.Ar_3$: $+4.6$ cm^{-1}). Additional satellite bands appeared due to intermolecular photofragmentation. A second band found for FB.Ar at 20 cm^{-1} was assigned to a vdW vibration ($\nu_{vdW}=43$ cm^{-1}). Similar results were obtained for $FB.Kr_n$ ($n<3$). The spectra of the homogeneous clusters FB_2 and FB_3 were more complex. The dimer spectrum showed two broad spectral features, one blue-the other red-shifted relative to λ_{00}. Each one is probably due to a different isomer. (48 refs.)

117936 Autoionization spectra of Li_2 and the $X^2\Sigma_g^+$ ground state of Li_2^+: experimental and theoretical investigations. D.Eisel, W.Demtroder (Fachbereich Phys., Univ. Kaiserslautern, Kaiserslautern, Germany), W.Muller, P.Botschwina.
Chem. Phys. (Netherlands), vol.80, no.3, p.329-44 (15 Oct. 1983).
Autoionizing Rydberg levels of Li_2 molecules in a supersonic molecular beam are populated by stepwise exciton with two tunable pulsed dye lsers. The observed autoionization spectra show severe perturbations. Based on calculations of quantum defects and a perturbation treatment of l-uncoupling a tentative assignment of Rydberg series up to $n=32$ is proposed. The convergence limits of these series yield a value of IP-41475 cm^{-1} for the adiabatic ionization potential and a vibrational constant $\omega_e=263$ cm^{-1} for the $X^2\Sigma_g^+$ ground state of Li_2^+. The experimental results are compared with ab initio calculations combined with a core polarization potential, which yield the potential curve, the dissociation energy, the quadrupole moment and the vibrational frequency for the $X^2\Sigma_g^+$ ground state of Li_2^+, in excellent agreement with experimental findings. (43 refs.)

117937 Angular distribution for the major photoelectron bands of nitrogen below 45 eV binding energy. F.A.Grimm (Dept. of Chem., Univ. of Tennessee, Knoxville, TN, USA), T.A.Carlson.
Chem. Phys. (Netherlands), vol.80, no.3, p.389-94 (15 Oct. 1983).
Measurements on the angular-distribution parameter, β, for photoionisation from the $3\sigma_g$, $1\pi_u$ and $2\sigma_u$ orbitals of nitrogen have been extended to a photon energy of 70 eV. At the higher photon energies the agreement between theory and experiment is improved over that obtained at lower photon energies. The angular-distribution parameter for photonization from the $2\sigma_g$ orbital (≈ 38 eV) and the main satellite band at 29 eV are reported for the first time. The angular-distribution parameter, as measured over the 38 eV band, is consistent with two or more transitions to $^2\Sigma_g^+$ states which obtain their intensity from a $(2\sigma_g)^{-1}$ hole configuration. Results for the $2\sigma_g$ inner valence band at 38 eV are also consistent with one-electron continuum multi-scattering $X\alpha$ calculations. The major features of the inner valence region (20-45 eV) may be explainable using an excited-state molecular-orbital picture coupled to the outermost valence orbitals. (14 refs.)

117938 Optical absorption, electron spin resonance, and electron spin echo studies of the photionization of tetramethylbenzidene in cationic and anionic synthetic vesiscles: comparison with analogous micellar systems. A.S.W.Li, L.Kevan (Dept. of Chem., Univ. of Houston, Houston, TX, USA).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5752-5 (7 Sept. 1983).
The photoionization of *N,N,N′,N′*-tetramethylbenzidine (TMB) in dihexadecylphosphate anionic vesicles and in dioctadecyldimethylammonium chloride cationic vesicles has been studied by optical absorption and electron spin resonance in liquid and frozen solutions. The TBM cation has been observed to be stabilized in both types of vesicles. The photionization efficiency is about twofold greater in the cationic vesicles compared to the anionic vesicles. Shifts in the optical absorption maximum between micellar and vesicle solutions indicate that TMB is in a less polar environment in the vesicle systems. Electron spin echo modulation spectrometry has been used to detect TMB cation-water interactions that are weaker than in previously studied micellar solutions. This is consistent with the optical absorption results and with an asymmetric solubilization site for TMB and TMB^+ within the vesicular structure. A new absorption in the photoionized vesicles is assigned to a nonparamagnetic diamine-diimine charge-transfer complex between two TMB cations in the same vesicle. This complex is not formed in micellar systems. (19 refs.)

117939 Study of $L_{2,3}M_{4,5}M_{4,5}$ Auger spectra of Zn and Cu in molecular $ZnCl_2$ and $(CuCl)_3$ vapours. S.Aksela, M.Kellokumpu, M.Harkoma (Phys. Dept., Univ. of Oulu, Oulu, Finland).
J. Electron Spectrosc. & Relat. Phenom. (Netherlands), vol.32, no.2, p.177-87 (Sept. 1983).
$L_{2,3}M_{4,5}M_{4,5}$ Auger electron spectra of Zn and Cu have been measured in molecular $ZnCl_2$ and $(CuCl)_3$ vapours. The spectra have been analyzed and compared with the corresponding free-atom spectra. It is found that the main features of the spectra are atomic-like. The energies are shifted by 0.55 eV in $ZnCl_2$ and by 3.2 eV in $(CuCl)_3$ towards higher kinetic energy compared with the corresponding free-atom spectra. For the intensity ratios between the L_3 and L_2 groups, the values 2.8 and 3.7 are obtained for Zn and Cu, respectively. These intensity ratios, together with energy considerations based on free-atom Dirac-Fock calculations and observed Auger shifts, indicate that the $L_2L_3M_{4,5}$ Coster-Kronig process is energetically possible in $(CuCl)_3$ molecular clusters but not in $ZnCl_2$. The satellite structure in the spectra studied also supports this conclusion. (15 refs.)

117940 Determination of rotational alignment of $N_2^+B^2\Sigma_u^+$ and $CO^+B^2\Sigma^+$ following photoionization of N_2 and CO. J.A.Guest, K.H.Jackson, R.N.Zare (Dept. of Chem., Stanford Univ., Stanford, CA, USA).
Phys. Rev. A (USA), vol.28, no.4, p.2217-28 (Oct. 1983).
When a low-pressure (10^{-2}-Torr) sample of N_2 or CO is exposed to a beam of linearly polarized synchrotron radiation (18-34 eV), electronically excited molecular ions are formed whose subsequent unresolved emission is found to be partially polarized. The degree of polarization of the $N_2^+ B^2\Sigma_u^+ - X^2\Sigma_g^+$ fluorescence (~ 391 nm) and the $CO^+ B^2\Sigma^+ - X^2\Sigma^+$ fluorescence (~ 220 nm) is studied as a function of the energy of the ionizing radiation from threshold to higher energies. This information determines the alignment of the photoion, which in the case of N_2 must be corrected for depolarization caused by spin-rotation and hyperfine interaction. From the polarization of the fluorescence the authors deduce γ, the ratio of parity-unfavored to the sum of parity-favored contributions for photoelectron ejection. Comparison of the dynamical channel ratio γ with theoretical calculations for σ- and π-photoelectron ejection shows poor agreement for N_2 and fair agreement for CO. (45 refs.)

Explicit Hilbert-space representations of atomic and molecular photoabsorption spectra: computational studies of Stieltjes-Tchebycheff functions .... See Entry 117930

Evidence of dynamical effect on molecular autoionization from He^+ impact on He .... See Entry 117977

Time-of-flight mass spectrometry using multiphoton ionization and IR multiple photon dissociation: decomposition of the triethylamine cation .... See Entry 120650

Multiphoton ionization detection of photodissociation fragments: NO from CH_3ONO, C_2H_5ONO, and C_3H_7ONO .... See Entry 120652

33.80G Diffuse spectra; predissociation, photodissociation

117941 Photofragmentation of HI in the first continuum. G.N.A.Van Veen, K.A.Mohamed, T.Baller, A.E.De Vries (FOM-Inst. for Atomic & Molecular Phys., Amsterdam, Netherlands).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.113-20 (Oct. 1983).
Time-of-flight (TOF) spectra and the angular distributions of H atoms resulting from the photofragmentation of HI at 248 nm, 222 nm and 193 nm have been measured. The ratio for $I(^2P_{1/2})$ and $I(^2P_{3/2})$ formation and the symmetries of the repulsive excited states were obtained. From this information the potential-energy curves of the relevant excited states were calculated by means of the modified δ approximation. With these potential curves the $I(^2P_{1/2})/I(^2P_{3/2})$ ratio was deduced for DI. The thus calculated ratios for DI are in excellent agreement with the values known from the literature. (20 refs.)

117942 Comparison of photon-stimulated dissociation of gas-phase, solid and chemisorbed water. D.E.Ramaker (Surface Sci. Div., NBS, Washington, DC, USA).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.183-202 (Oct. 1983).
Recent electron- and photon-stimulated desorption (ESD/PSD) data for H_2O in the condensed phase and chemisorbed on GaAs (110) and Ti (001) are interpreted utilizing previously published photoemission, electron coincidence and Auger data along with theoretical calculations. Comparison with fragmentation data from the gas phase indicates that only two hole-one electron type states are effective for desorption in condensed or molecularly chemisorbed hydrogen bonded water. The $1b_2^{-1}$ excitation, which effectively dissociates H_2O gas via predissociation, is ineffective in the condensed phase because of the presence of intermolecular decay mechanisms which compete with the predissociation process. Hydrogen bonding reduces the effectiveness of the '$2a_2^{-1}$' excitation for H^+ desorption. The $1b_1^{-2}4a_1$ and $1b_1^{-1}3a_1^{-1}4a_1$ two hole-one electron states are sufficiently long lived; occupation of the strongly antibonding $4a_1$ orbital also makes them repulsive. (102 refs.)

117943 Infrared-enhanced multiphoton dissociation of iodobenzene cations. N.B.Lev, R.C.Dunbar (Chem. Dept., Case Western Reserve Univ., Cleveland, OH, USA).
Chem. Phys. (Netherlands), vol.80, no.3, p.367-78 (15 Oct. 1983).
When gas-phase iodobenzene cations in an ion cyclotron resonance spectrometer are irradiated simultaneously with visible 610 and IR 977 cm^{-1} photons, the visible two-photon process is enhanced by a factor of up to three. The experimental pressure and intensity dependence can be modeled using a set of rate equations for the evolution of the populations of different internal energy levels. Modeling suggests that the major mechanism for the mixed visible/IR process is the absorption of several IR photons, followed by the absorption of one visible photon which brings about dissociation; that the visible photoexcitation cross section decreases with increasing ion internal energy; that IR pumping does not compete successfully with relaxation processes near dissociation threshold; and that the IR radiative relaxation time is constant ≈ 500 ms. (23 refs.)

117944 Role of coherence in multiquantum excitation of molecules by IR laser radiation. A.M.Samson, V.A.Savva, G.K.Paramonov.
J. Appl. Spectrosc. (USA), vol.38, no.1, p.63-72 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.76-87 (Jan. 1983).
The authors show that when coherence of the excitation is included, there are qualitative changes occurring in the system. Under collisionless conditions, when neither energy nor phase relaxation is present, a multilevel system with degenerate levels is excited in a completely different manner than a one-dimensional multilevel system. (33 refs.)

Vibrational predissociation of Van der Waals clusters of ethylene .... See Entry 117866

Photodissociation dynamics of triatomic molecules—effect of predissociation on diatomic fragment fluorescence polarization .... See Entry 117919

Two-frequency two-photon ionization of nascent PO($X^2\Pi$) from the collision-free IR photolysis of dimethyl methylphosphonate .... See Entry 117934

Intensity dependence of CO_2-laser-induced multiphoton absorption and decomposition of monomethylamine .... See Entry 117946

Time-of-flight mass spectrometry using multiphoton ionization and IR multiple photon dissociation: decomposition of the triethylamine cation .... See Entry 120650

Metal carbonyl bond strengths: applications of photoacoustic calorimetry .... See Entry 120651

Multiphoton ionization detection of photodissociation fragments: NO from CH_3ONO, C_2H_5ONO, and C_3H_7ONO .... See Entry 120652

Temperature dependence of the carbon dioxide photoabsorption cross section between 1200 and 1970 Å ....See Entry 120655

NO fluorescence during vacuum-ultraviolet photodissociation of $CFCl_2NO$ ....See Entry 120656

33.80K Multiphoton processes

117945 The effect of added nitrogen on multiphoton absorption by ammonia. I.M.Waller, D.K.Evans, R.D.McAlpine (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada).
Appl. Phys. B (Germany), vol.B32, no.2, p.75-8 (Oct. 1983).
Multiphoton absorption (MPA) of the CO_2 laser 9 μm $R(30)$ line (pulse width 60 ns, FWHM) by NH_3 and NH_3/N_2 mixtures was studied as a function of gas composition, pressure and laser fluence (ϕ). MPA occurs for values of ϕ which are less than the values that have been used for optically pumped NH_3/N_2 lasers; consequently a simple two-level absorption model will not adequately describe laser action in these systems. The photon energy deposited in NH_3/N_2 mixtures can be calculated from the MPA cross-section and the fluence dependence of the illumination geometry. An examination of the efficiency of conversion of this absorbed energy to the reported radiant energy of optically pumped NH_3/N_2 lasers shows an optimum value which depends on pressure, and gas composition. (21 refs.)

117946 Intensity dependence of CO_2-laser-induced multiphoton absorption and decomposition of monomethylamine. D.K.Evans, R.D.McAlpine, H.M.Adams, A.L.Greagh (AECL, Chalk River Nuclear Labs., Chalk River, Ontario, Canada).
Chem. Phys. (Netherlands), vol.80, no.3, p.379-88 (15 Oct. 1983).
The infrared multiphoton absorption (MPA) and decomposition (MPD) of monomethylamine have been studied using temporally smooth CO_2-laser pulses of 6, 9 and 40 ns fwhm. Both MPA and MPD depend on gas pressure (0.267-1.33 kPa) at each pulse width; but results for different pulse widths did not simply scale with collision number. At each pressure, MPA and MPD depend on laser-pulse intensity as well as fluence confirming the suggestion of previous workers. (28 refs.)

117947 Multiphoton transitions in gases at microwave frequencies. G.Alzetta, A.Battaglia (Dipartimento di Fisica, Univ. di Pisa, Pisa, Italy).
J. Phys. Lett. (France), vol.44, no.18, p.L755-9 (15 Sept. 1983).
Multiphoton transitions are produced irradiating a gas by two microwave power sources. Three-photon transitions in NH_3 and OCS have been studied as a function of frequency, power and density of gases. Measurements agree fairly well with theoretical predictions. (3 refs.)

117948 Chaos in multiple-photon excitation of molecules. J.R.Ackerhalt, H.W.Galbraith (Los Alamos Nat. Lab., Los Alamos, NM, USA), P.W.Milonni.
Phys. Rev. Lett. (USA), vol.51, no.14, p.1259-61 (3 Oct. 1983).
With use of a Hamiltonian model system to represent IR laser excitation of a molecule it is shown that chaos is a fundamental aspect of this physical process. On average the chaos leads to a fluence-dependent absorption which previously was attributed to rapid statistical equilibration of energy in the quasicontinuum and was modeled by population rate equations. The origin of the chaos is the interplay of the pump mode's anharmonicity and intramolecular energy transfer. (7 refs.)

117949 Spectral characteristics of the excitation of SF_6 molecules by an intense infrared laser field under strong cooling conditions. S.S.Alimpiev, N.V.Karlov, S.M.Nikiforov, A.M.Prokhorov, B.G.Sartakov, E.M.Khokhlov, A.L.Shtarkov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.331-5 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.562-9 (March 1983). [received: Oct. 1983]
A study was made of the fine structure of the excitation of the lower vibrational levels in SF_6 molecules gasdynamically cooled to temperatures of the order of 30K. A two-frequency infrared-infrared laser excitation method was employed. A continuously tunable CO_2 laser was found for the first stage. At a frequency of 944.39 cm^{-1} a contrast absorption peak was detected, having a width of less than 0.1 cm^{-1} and corresponding to the A_{1g} two-photon resonance. (17 refs.)

Infrared multiphoton excitation of SO_2 to fluorescent states ....See Entry 117903

IR multiple-photon excitation distribution probed by IR fluorescence ....See Entry 117905

Matrix-isolation spectroscopy of Pb_2 .... See Entry 117914

Double enhancement of the multiphoton ionization of nitric oxide ....See Entry 117931

Two-frequency two-photon ionization of nascent PO($X^2\Pi$) from the collision-free IR photolysis of dimethyl methylphosphonate ....See Entry 117934

Electronic spectroscopy of fluorobenzene Van der Waals molecules by resonant two-photon ionization ....See Entry 117935

Infrared-enhanced multiphoton dissociation of iodobenzene cations ....See Entry 117943

Role of coherence in multiquantum excitation of molecules by IR laser radiation ....See Entry 117944

Time-of-flight mass spectrometry using multiphoton ionization and IR multiple photon dissociation: decomposition of the triethylamine cation ....See Entry 120650

Multiphoton ionization detection of photodissociation fragments: NO from CH_3ONO, C_2H_5ONO, and C_3H_7ONO ....See Entry 120652

34.00 ATOMIC AND MOLECULAR COLLISION PROCESSES AND INTERACTIONS

34.10 GENERAL THEORIES AND MODELS

(inc. statistical theories, transition state, stochastic and trajectory models, etc; see also 82.20)

117950 Analytical molecular surface calculation. M.L.Connolly (Dept. of Molecular Biology, Res. Inst. of Scripps Clinic, La Jolla, CA, USA).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.548-58 (1 Oct. 1983).
A computer algorithm is presented for calculating the part of the van der Waals surface of a molecule that is accessible to solvent. The solvent molecule is modeled by a sphere. This sphere is, in effect, rolled over the molecule to generate a smooth outer-surface contour. This surface contour is made up of pieces of spheres and tori that join at circular arcs. The spheres, tori and arcs are defined by analytical expressions in terms of the atomic coordinates, van der Waals radii and the probe radius. The area of such surface piece may be calculated analytically and the surface may be displayed on either vector or raster computer-graphics systems. These methods are useful for studying the structure and interactions of proteins and nucleic acids. (16 refs.)

34.20 INTERATOMIC AND INTERMOLECULAR POTENTIALS AND FORCES

(for molecular solids, see 31.70K)

117951 Investigation of particularities found in intermolecular interaction for glycerine solutions with ordinary and heavy water through acoustic methods. V.N.Hudaiberdyev (Thermophys. Dept., Acad. of Sci., Tashkent, USSR).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.5-6, p.275-82 (1983).
Acoustic methods are presented for investigating the structure and the mechanisms of intermolecular interactions in glycerine solutions with ordinary and heavy water. The volume and shear relaxation has been found for the investigated systems. The molecular mechanisms are suggested to re-arrange the structure of glycerine and its water solutions based upon certain relaxation and thermal properties peculiar to the discovered acoustic dispersion fields, as well as upon the high resolution electron spin resonance (ESR) and the nuclear magnetic resonance (NMR) spectra analysis. The particularity of the glycerine water solution structures (the glycerine concentration was equal to 0.3 mol.%) has been attributed to a higher compactibility and stability of water solutions conditioned by the specified character of the formation and the breakage of intermolecular hydrogen bonds in the glycerine associators and its water complexes. (9 refs.)

117952 Calculation of forces of molecular interaction of metals in vacuum over a broad region of distances. Ya.I.Rabinovich (Inst. of Phys. Chem., Acad. of Sci., Moscow, USSR).
Colloid J. USSR (USA), vol.44, no.6, p.964-9 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1096-101 (Nov.-Dec. 1982). [received: Sept. 1983]
On the basis of the macroscopic theory of molecular forces, approximate analytical formulae have been derived for the calculation of the specific energy and forces of interaction (disjoining pressure) of two metals separated by a plane-parallel air gap, in the transition region and in the region of large distances. With $2 \leq H \leq 1000$ nm, the results of the calculations based on the proposed formulas are within 10% of the results obtained in computer calculations using the original formulas of the macroscopic theory. (12 refs.)

117953 An analytic method for the calculation of electrostatic molecular potentials. M.J.Ramos, B.Webster (Dept. of Chem., Univ. of Glasgow, Glasgow, Scotland).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1389-98 (Sept. 1983).
A new analytic method is presented for the calculation of the electrostatic potential of any molecule. Analytic expressions are given for *s*- and *p*-type gaussian functions and the source for expressions involving *d*-type gaussian functions is noted. The use of Slater functions requires a representation by a gaussian expansion. An extension of the theory is made for contracted gaussian functions. Isopotential maps are shown for several small molecules. (7 refs.)

117954 An initio calculation of the Heisenberg exchange interaction between O_2 molecules. M.C.van Hemert (Vakgroep Fysische en Macromoleculaire Chem., Rijksuniv. Leiden, Leiden, Netherlands), P.E.S.Wormer, A.van der Avoird.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1167-70 (26 Sept. 1983).
The exchange interaction between ${}^3\Sigma_g{}^- O_2$ molecules, as obtained from ab initio calculations for a singlet, triplet, and quintet dimer, can be well represented by the Heisenberg Hamiltonian. The coupling parameter J depends exponentially on the O_2-O_2 distance, with exponents ranging from 3.6 to 4.2 $Å^{-1}$ for different O_2 orientations. For most orientations the coupling is antiferromagnetic, but for a few J is positive. The different neighbor interactions in α and β O_2 solids, which determine their magnetic order and properties, have been evaluated. (24 refs.)

117955 Vibrational interaction potentials. Y.von Bergen, R.von Bergen (Dept. of Chem., Simon Bolivar Univ., Caracas, Venezuela), B.Linder.
Theor. Chim. Acta (Germany), vol.63, no.4, p.317-22 (1983).
An expression is derived for the interaction potential arising from the correlative vibrational motion of fluctuating dipolar diatomic molecules, using as model the Morse oscillator. The theory is applied to two interacting NaCl molecules. The vibrational dipole-dipole coefficient, C_6, is strongly temperature dependent with a value at room temperature of 3.788×10^{-62} erg cm^6. (7 refs.)

117956 Semiclassical calculation of lower potential curves of hydrogen ion. N.V.Semenova.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.72-6 (Aug. 1983). In Russian.
The comparison equation method is used for investigating lower potential curves of the hydrogen molecular ion. This method significantly improves existing semiclassical results in some ranges of internuclear distance. (15 refs.)

Tests of the orbital stasis and orbital following models ....See Entry 117756

Compliant fields for water, ammonia, and methane .... See Entry 117777

Theoretical investigation of the interaction of propene with a sodium ion ....See Entry 117790

A non-van der Waals minimum of the $He(^1S)+H_2(B^1\Sigma_u{}^+)$ excited surface ....See Entry 117792

Vibrational analysis of SiH_2F_2 and SiD_2F_2 ....See Entry 117853

Collision induced rotational spectrum of allene ....See Entry 117873

Close-coupling calculations of polarized rotational cross sections for (Ar, LiF) ....See Entry 117962

A method for predicting the anharmonicity constants $\omega_e\chi_e$ of halides of sodium ... .See Entry 118015

34.40 ELASTIC SCATTERING OF ATOMS AND MOLECULES

Influence of different collisional processes on the Stark broadening ....See Entry 117828

Elastic collision cross sections for laser-induced diffusion .....See Entry 117970

34.50 INELASTIC SCATTERING OF ATOMS AND MOLECULES

117957 Investigations on the thermionic diode: the ionisation probability of Rb n^2P_J atoms by noble gas collisions. K.Niemax (Inst. fur Experimentalphys., Univ. Kiel, Kiel, Germany).
Appl. Phys. B (Germany), vol.B32, no.2, p.59-62 (Oct. 1983).
By using the frequency-doubled light of a single-mode dye laser the effect of noble gas collisions (Ne and Xe) on the intensities of the Rb principal series lines $5S-nP$ ($n\geq15$) has been studied in a thermionic diode. The signal intensities of the low-lying lines of the series could be increased considerably by applying higher noble-gas pressures. The intensities of the high-lying lines were found to be pressure independent indicating a constant ionisation probability of highly excited atoms by collisions. By comparing the diode signals of the discrete lines with the ionisation continuum it is shown that the ionisation probability of high-lying levels is unity within the experimental error. (19 refs.)

117958 The quenching of anthracene triplets by ground-state anthracene. J.Saltiel, G.R.Marchand, R.Dabestani, J.M.Pecha (Dept. of Chem., Florida State Univ., Tallahassee, FL, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.219-22 (9 Sept. 1983).
The first-order decay constant, k_{dt}, of anthracene triplets, $^3A^*$, in benzene depends linearly on ground-state anthracene, ^1A, concentration: $k_{\mathrm{dt}}=k_{\mathrm{d}}{}^{0}{}_{\mathrm{t}}+k_{\mathrm{sq}}[^1A]$, where $k_{\mathrm{d}}{}^{0}{}_{\mathrm{t}}=49\pm12\ s^{-1}$ and $k_{\mathrm{sq}}=(3.19\pm0.10)\times10^5\ M^{-1}\ s^{-1}$ at 23°C. The actual involvement of ^1A in the quenching process is unequivocally established by varying $[^1A]$ in situ through a sequence of partial photodimerization steps. The temperature dependence of k_{sq} being normal, $k_{\mathrm{sq}}=3.89\times10^8\ \exp(-4.19/RT)$, while not precluding it, does not require formation of triplet anthracene excimer. Less extensive but similar results are reported with cyclohexane and ethanol as solvents. (19 refs.)

117959 Collisional relaxation of backward photon echo in molecular sodium. S.Asaka, H.Yamada, H.Nakatsuka, M.Matsuoka (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3029-38 (Sept. 1983).
Backward photon echo and its decay were observed in the $X\Sigma$-$A\Sigma$ transition of Na_2 undergoing collisions with Ar buffer gas. By using the quantum mechanical transport equation, expressions of the various collisional cross sections are presented. The results are applied to the experiment, and several kinds of cross sections are obtained for the Na_2-Ar system. Furthermore by assuming the Gaussian collision kernel, two parameters of the population kernel are derived for the $Na_2(X\Sigma)$-Ar collisions.

117960 Time evolution of ion swarm transport in a constant mean free time encounter region. T.Makabe, K.Misawa, T.Mori (Dept. of Electrical Engng., Keio Univ., Yokohama, Japan).
J. Phys. D (GB), vol.16, no.10, p.1893-900 (14 Oct. 1983).
Ion swarm transport is simulated by a Monte Carlo technique in the case of a constant mean free time collision model with isotropic scattering after the ions have been released into a gas with a δ-function distribution in space and a steady-state velocity distribution. The time behaviour of the transport coefficients is investigated for ion-molecule mass ratios m/M of 0.1, 1.0 and 10 under the condition that the field energy is one hundred times greater than the thermal energy. In particular, discussion is given for the skewness and excess of the density distribution. It is also shown that these higher-order coefficients become increasingly important with decreasing m/M. (10 refs.)

117961 Quasienergetic method in the theory of opticocollisional transitions. P.A.Apanasevich, A.P.Nizovtsev.
J. Appl. Spectrosc. (USA), vol.38, no.1, p.1-16 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.5-21 (Jan. 1983).
The authors outline a general method—the method of particles 'covered' by the field—which allows the various opticocollisional transitions to be considered from a single viewpoint. One- and two-photon bound-bound transitions in weak and strong fields are considered in detail. The cross sections of such transitions are found, and their dependence on the characteristics of the radiation is analysed. (40 refs.)

117962 Close-coupling calculations of polarized rotational cross sections for (Ar, LiF). D.W.Davies (Dept. of Chem., Univ. of Birmingham, Birmingham, England).
Mol. Phys. (GB), vol.50, no.1, p.229-41 (Sept. 1983).
Close-coupling calculations with 121 channels at an energy of 155 cm^{-1} have been made for the rotational scattering of LiF by Ar, using a Lennard-Jones type potential with long range anisotropic terms. Integral cross sections for transitions $(jm_j)\rightarrow(j'm_j)$ are given for $j=0,1,2,3,4$ and $j'=0,1,2,3,4,5$, and also for the $j=0\rightarrow8$ and $j=0\rightarrow10$ transitions. Differential cross sections were obtained for $\Delta j=1$ and $j=0,1,2,3$, and for $j=1\rightarrow1$, $1\rightarrow3$, $0\rightarrow2$ and $3\rightarrow3$ transitions. Rotated scattering amplitudes were used to obtain integral cross sections by numerical integration, but these show little evidence that for $\Delta j\neq0$ the $\Delta m=0$ transition has a relatively large cross section along an axis perpendicular to the bisector of the angle betwen the initial and final relative velocity vectors. Certain rules for Δm are suggested, and a comparison with experimental results for (Ar, LiF) and (Ar, CsF) is given. (33 refs.)

117963 First observation of the Thomas peak in continuum capture: capture of H atoms from CH_4 molecules by fast Ar^+ projectiles. M.Breinig, G.J.Dixon, P.Engar, S.B.Elston, I.A.Sellin (Univ. of Tennessee, Knoxville, TN, USA).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1251-4 (3 Oct. 1983).
Energy spectra of protons emerging near the forward direction for 100-300-eV/u Ar^+ beams incident on CH_4 were recorded. Cross sections for the capture of H atoms from CH_4 molecules into states lying in the vibrational continuum of the electronic ground state and into predissociative states of ArH^+ molecules were measured as a function of projectile energy. Capture occurs via the Thomas double-scattering mechanism. (21 refs.)

117964 Molecular treatment of charge transfer in Li^++Ca collisions. M.Kimura, H.Sato, R.E.Olson (Dept. of Phys., Univ. of Missouri, Rolla, MO, USA).
Phys. Rev. A (USA), vol.28, no.4, p.2085-90 (Oct. 1983).
The perturbed-stationary-state method, appended with electron translation factors, has been applied to charge transfer in Li^++Ca collisions for energies from 0.1 to 20 keV/amu. The Born-Oppenheimer wave functions and eigenvalues were generated using the pseudopotential technique, which reduced the many-electron system to a simpler two-electron problem. The molecular ground-state $X^1\Sigma^+$ is calculated to be bound and has the potential-well parameters $R_e=6.20a_0$, $D_e=1.11$ eV, $\omega_e=235\ cm^{-1}$, and $B_e=0.263\ cm^{-1}$. From the scattering computations, a representative value for the charge-transfer cross section is $4\times10^{-15}\ cm^2$ at 5 keV/amu. The cross section decreases rapidly as the energy is reduced below 1 keV/amu. At all energies studied, the dominant electron-capture reaction product is the ground-state Li atom. (21 refs.)

117965 Proton-stopping power of argon, krypton, and xenon. E.J.McGuire (Sandia Nat. Labs., Albuquerque, NM, USA).
Phys. Rev. A (USA), vol.28, no.4, p.2096-103 (Oct. 1983).
Parameters for the Bethe stopping-power theory for Ar, Kr, and Xe are obtained both via integration over optical oscillator strengths and from explicit plane-wave Born-approximation calculations. The former procedure produces a Bethe mean excitation energy (I) significantly lower than that measured, while the latter procedure produces I values within 10 eV of the measured values for Ar and Kr. For Xe the experimental I value lies midway between the two calculated I values. Inner-shell corrections are obtained from the explicit calculations. The K-shell corrections (C_K) are a factor of 2 larger than those obtained from hydrogenic calculations. The total inner-shell correction ($\Sigma_{nl}\ C_{nl}$) is in qualitative agreement for Ar, Kr, and Xe with results from a statistical model. However, the quantitative difference between the two sets of inner-shell corrections leads to significant increases in I values inferred from experimental measurements below 1 MeV proton energy. (17 refs.)

117966 $N_2{}^+$ first-negative emission cross sections for low-energy H^+ and H impact on N_2. B.Van Zyl, M.W.Gealy, H.Neumann (Dept. of Phys., Univ. of Denver, Denver, CO, USA).
Phys. Rev. A (USA), vol.28, no.4, p.2141-50 (Oct. 1983).
Absolute emission cross sections for the (0,1), (1,2) and (2,3) band emission sequence of the $N_2{}^+$ first-negative system have been measured for low-energy H^+ and H collisions with room-temperature N_2 molecules. The energy range covered for H^+ impact was from 63 eV to 2.0 keV, and that for H impact was from 160 eV to 2.5 keV. For $H+N_2$ collisions, cross sections for N_2 second-positive emissions for the (1,5) and (2,6) emission bands were also determined. The total cross sections for production of $N_2{}^+(B)$ and $N_2(C)$ were determined from these measured results. The techniques used to accomplish the measurements are described, and the cross sections obtained are compared with the results of other investigations. (44 refs.)

117967 Effective cross section for depolarization of an alkali metal atom in a collision with an alkali halide molecule. O.S.Vasyutinskii (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.560-1 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1302-5 (Nov. 1982). [received: Sept. 1983]
Reports a determination of the effective cross section for the depolarization of cesium atoms in collisions with CsI molecules. The interest in this subject stems from the possibility of obtaining important information about the mechanisms for atom-atom and atom-molecule collisions—information which is difficult to obtain by other methods. Previous research, however, has been restricted to materials which cause an extremely slight depolarization of atoms oriented in their ground state, because of the difficulty in arranging direct optical orientation of alkali metals under strong-relaxation conditions. In the present experiments, oriented cesium atoms are produced by irradiating a vapor of alkali halide molecules (CsI) by circularly polarized ultraviolet light. The mechanism involved is the orientation of the atoms during the photodissociation of the molecules. The effective depolarization cross section is determined by measuring the linewidth of the magnetic-resonance signal in the ground state of the atoms oriented in this manner. (8 refs.)

Observation of Na I inner shell-excited quartet terms ....See Entry 117823

Theoretical determination of fine-structure transitions occurring in collisional redistribution of light ....See Entry 117825

Information theory of line-shape in collision-induced absorption ....See Entry 117834

Rb and Cs broadening of the Na resonance lines ....See Entry 117838

Collision induced rotational spectrum of allene ....See Entry 117873

Quenching of the fluorescence of substituted benzenes by halomethanes ....See Entry 117901

Vacuum ultraviolet photoelectron spectroscopy of transient species. XVI. The $NCO(X^2\Pi)$ radical ....See Entry 117926

Near resonance charge transfer from a laser excited donor state ....See Entry 117986

Second-order approximations for the transport properties of dilute polyatomic gases ....See Entry 118703

34.50E Rotational and vibrational energy transfer

117968 Vibrational effects with excitation transfer in metastable rare-gas-halide collisions. M.S.De Vries, R.M.Martin (Dept. of Chem., Univ. of California, Santa Barbara, CA, USA).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.157-65 (Oct. 1983).
Collisions of $Ar(^3P_{2,0})$ and $Kr(^3P_{2,0})$ with Cl_2 and Br_2 were studied over the collision energy range 0.01-0.5 eV, using a crossed-beam time of flight technique. The dependence of the total chemiluminescence cross sections (from excimer formation plus excitation transfer) on collision energy follows the behavior expected from the orbiting-controlled curve-crossing model. The energy dependence for excitation transfer does not follow this model, and is quite different for Cl_2 versus Br_2. These results are explained by a phase-matching curve-crossing model, in terms of the $A^+/X_2{}^-$ trajectory motion and the phase of the $X_2{}^-$ vibrational motion. (25 refs.)

117969 Semiclassical calculation of energy transfer in polyatomic molecules. IX. Cross sections for $M+CO_2\ (000)\rightarrow M+CO_2(nml)$ (M=He and Ar). G.D.Billing (Dept. of Chem., Panum Inst., Copenhagen, Denmark), D.C.Clary.
Chem. Phys. (Netherlands), vol.80, no.3, p.213-19 (15 Oct. 1983).
Cross sections for exciton of the asymmetric-stretch vibrational manifold of CO_2 in collision with He and Ar have been calculated using a semiclassical

collision method and a potential-energy surface constructed from self-consistent field data. The cross sections for collisional energies up to 2.0 eV are compared with those obtained in a molecular-beam experiment. (15 refs.)

117970 Elastic collision cross sections for laser-induced diffusion. N.M.Lawandy (Div. of Engng., Brown Univ., Providence, RI, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1257-8 (Aug. 1983).
The author presents a method for estimating the change in the hard sphere collision cross section for a polyatomic molecule associated with vibrational excitation. The final result is only related to spectroscopic and virial coefficient data. The ability to theoretically estimate this cross section change is vital to the theoretical modeling of light-induced drift separation schemes in polyatomic mixtures. (9 refs.)

117971 Dipolar transitions induced by collisions with formaldehyde molecules. Electric field effects. J.-C.Chardon, C.Genty, E.K.Hlil, J.-C.Labrune (Lab. de Spectroscopie Hertzienne et d'Electronique, Besancon, France).
J. Phys. (France), vol.44, no.10, p.1149-56 (Oct. 1983).
Using a H_2CO molecular beam, a method is first described which permits the observation of rotational transitions $\Delta J = \pm n(n \geq 1)$, induced by collisions with the molecules of a target gas. In the case $H_2CO \rightarrow H_2CO$, selection rules are defined and rotational resonance effects are observed on the differential cross sections for some $\Delta J = -1$ transitions. It appears that a direct electric field E considerably modifies the H_2CO cross sections σ_J. Using the pair $H_2CO \rightarrow NH_3$, the study of σ_J variations with E shows that the $\Delta J = 0$ transitions become forbidden, when E is intense. The experimental results are compared with the theoretical transition probabilities variations due to E and calculated in the Born approximation. An experimental method is deduced which permits, by application of an electric field, to select $\Delta J = 0$ transitions on a molecular beam. (24 refs.)

117972 Effects of quantum flux on the relaxation of paired modes of the CO_2 molecule. V.N.Faizulaev.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.738-43 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR)*, vol.23, no.6, p.9-14 (Nov.-Dec. 1982). [received: Sept. 1983]
Previously, a solution was found to the relaxation problem for anharmonic oscillators that incorporates the quantum flux excited by V-V exchange under nonequilibrium conditions. The present author makes a more detailed study of the vibrational kinetics of paired CO_2 modes using this method. (13 refs.)

117973 Determination of the relaxation time of the 103 H_2O vibration with an optoacoustic spectrometer and a ruby laser. B.G.Ageev, O.Yu.Nikiforova, Yu.N.Ponomarev (Inst. of Atmospheric Optics, Acad. of Sci., Tomsk, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.361-3 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.608-11 (March 1983). [received: Oct. 1983]
A method was developed for the determination of the vibrational-translational (*VT*) relaxation time of gases, based on the dependence of the sensitivity of an optoacoustic detector on the pressure of the investigated gas in a cell under pulse excitation conditions. An optoacoustic spectrometer and a pulsed ruby laser were used to determine the relaxation time of the 103 vibration in H_2O vapor. The value obtained, $\tau_{VT}(103) = (2.1 \pm 0.4) \times 10^{-7}$ sec.atm, was in qualitative agreement with the results of an experimental determination of the *VT* relaxation time of the lower H_2O vibration modes (010, 100, 001, 020). (15 refs.)

Neutron scattering model for benzene .... See Entry 118000

Experimental check on a theoretical model for a CO_2 GDL based on combustion products at high stagnation temperatures .... See Entry 118116

34.50H Electronic excitation and ionization (inc. beam-foil excitation and ionization)

117974 Collisional excitation of SF_6 and WF_6 by superthermal K. G.W.Black, M.A.D.Fluendy, S.L.Lunt (Dept. of Chem., Univ. of Edinburgh, Edinburgh, Scotland).
Mol. Phys. (GB), vol.50, no.1, p.153-9 (Sept. 1983).
Differential inelastic scattering cross sections have been measured for the systems $K + SF_6$, WF_6. Only weak excitation is seen in the neutral scattering. The gateway mechanism operating in these collisions is discussed. (19 refs.)

117975 Impact-parameter dependence of energy loss in light ions scattering by a gold atom. G.A.Iferov, V.A.Khodyrev, E.I.Sirotinin, Yu.N.Zhukova (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Phys. Lett. A (Netherlands), vol.97A, no.7, p.283-5 (12 Sept. 1983).
In the measurement of energy loss Q within the collision parameter interval 0.02 Å $\lesssim b \lesssim$ 0.4 Å a plateau of the curve of $Q(b)$ at $b \lesssim 0.1$ Å has been revealed which may be associated with the polarization of the electronic shell of a gold atom. (8 refs.)

117976 New experimental investigations of the density effect on inner-shell excitation and energy loss. J.F.Bak, F.E.Meyer, J.B.B.Petersen, E.Uggerhoj, K.Ostergaard (Inst. of Phys., Univ. of Aarhus, Aarhus, Denmark), S.P.Moller, A.H.Sorensen.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1163-6 (26 Sept. 1983).
The large spread in γ values ($1\text{-}10^5$) for gigaelectronvolt secondary beams has been used in a novel technique to measure the relativistic effects on inner-shell excitation in Cu and Al and energy loss in Si and Ge. In *K*-shell excitation, a pronounced influence of density effect is found for the first time, in apparent contradiction to earlier measurements, where the lack of density effects has been a great mystery. These problems are explained as target-thickness effects in connection with transition radiation. (18 refs.)

117977 Evidence of dynamical effect on molecular autoionization from He^+ impact on He. N.Tokoro, S.Takenouchi, N.Oda (Res. Lab. for Nuclear Reactors, Tokyo Inst. of Technol., Tokyo, Japan).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1255-8 (3 Oct. 1983).
Measurements have been done for ejected-electron spectra from 5-27-keV He^+ impact on He. A bandlike structure is observed in the higher-energy part of the spectra and theoretically reproduced as a result of molecular autoionization of ${He_2}^+$. The value of autoionization width Γ_A is closely proportional to the energy of the incident He^+ ion. This result leads to the conclusion that the dominant process for the observed molecular autoionization is due to the dynamical couplings. (17 refs.)

117978 Equilibrium charge-state distributions of 35-146 MeV Cu ions behind carbon foils. K.Shima, T.Ishihara, T.Miyoshi, T.Mikumo (Tandem Accelerator Center, Univ. of Tsukuba, Ibaraki, Japan).
Phys. Rev. A (USA), vol.28, no.4, p.2162-8 (Oct. 1983).
Equilibrium charge-state distributions of Cu ions behind carbon foils have been measured in the energy region 35-146 MeV. The equilibration is obtained with about 30- and 50-μg/cm^2-thick carbon at energies of 65 and 120 MeV, respectively. Almost-constant values of distribution widths have been observed in the 35-47-MeV and 96-146-MeV energy regions. The former corresponds to the Cu ions whose outermost electrons are mainly distributed in the *M* shell, while the latter in the *L* shell. The asymmetry of the charge distribution has been observed in the boundary charge state between the Cu *L* and *M* shells. Such an asymmetric distribution function has been well approximated with the connection of two Gaussian distributions with an equal centroid but with different standard deviations. (32 refs.)

117979 Relative excitation functions for terms in C II, C III, and C IV populated in the beam-foil interaction. Y.Baudinet-Robinet, P.D.Dumont (Inst. de Phys. Nucleaire, Univ. de Liege, Liege, Belgium).
Phys. Rev. A (USA), vol.28, no.4, p.2169-72 (Oct. 1983).
Relative populations of terms in C II, C III, and C IV, excited after the passage of C^+ ions through a carbon foil, have been measured as a function of the projectile energy ($0.3 < E < 2.3$ MeV). These excitation functions are shown to depend on the energy of the term and, in C II, a dependence on the core configuration of the term is observed at low projectile energies ($E < 0.6$ MeV). The excitation functions are also compared to the charge-state-fraction curves as a function of the ion energy and this comparison generally allows an unambiguous identification of the charge of the ion emitting an unclassified transition in C II, C III, and C IV. (26 refs.)

117980 Analysis of proton-He resonances in very-low-energy collisions. S.Bosanac, K.Knesaurek (R. Boskovic Inst., Zagreb, Yugoslavia).
Phys. Rev. A (USA), vol.28, no.4, p.2173-80 (Oct. 1983).
Energy dependence of the H^+-He differential cross section is analyzed for a fixed scattering angle. The energy range is between 0.1 and 0.7 eV. Rather complex resonance structure is found in which it is difficult to isolate the contribution of a single resonance. (29 refs.)

117981 Atom-atom momentum-transfer cross section in the presence of resonances. S.Bosanac, K.Knesaurek (R. Boskovic Inst., Zagreb, Yugoslavia).
Phys. Rev. A (USA), vol.28, no.4, p.2190-4 (Oct. 1983).
The atom-atom momentum-transfer cross section is analyzed for low-energy collisions in which resonances may be present. It is shown that their contribution to this cross section can be substantial, and this is confirmed in the calculation on H^+-He system. (35 refs.)

Determination of the quenching rates of ${N_2}^+(B^2{\Sigma_u}^+, \nu=0,1)$ by N_2 using laser-induced fluorescence .... See Entry 117907

Generation of $^1O_2$ from O_2 quenching of the lowest excited singlet and triplet states of 9,10-diphenylanthracene .... See Entry 117908

Comments on 'Generation of $^1O_2$ and the mechanism of internal conversion in 9,10-diphenylanthracene' .... See Entry 117909

Generation of $^1O_2$ by 9,10-diphenylanthracene .... See Entry 117910

Penning collisions in hollow cathode He-Cd^+ lasers .... See Entry 118124

34.70 CHARGE TRANSFER

(see also 82.30 Charge transfer reactions)

117982 Charge transfer between neon ions and metastable helium. R.H.Neynaber, S.Y.Tang (Inst. for Pure & Appl. Phys. Sci., Univ. of California, San Diego, La Jolla, CA, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.316-19 (16 Sept. 1983).
Merging beams are used to measure cross sections for charge transfer in the NE^+-He($2^3S, 2^1S$) system at relative energies from 0.01 to 1000 eV. The results are in reasonable agreement with calculations obtained from a modified Demkov approach. (15 refs.)

117983 Electron transfer in proteins. S.Larsson (Dept. of Phys. Chem., Univ. of Lund, Lund, Sweden).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1375-88 (Sept. 1983).
Thermal electron transfer in protein structures is discussed on the basis of a model first proposed by R.A. Marcus. The electronic matrix element H_{12} is obtained in a many-electron theory for a number of typical structures of interest in proteins. Repetitive structures often permit resonance transfer over long distances provided the absolute value of the coupling matrix element between neighbouring atomic orbitals is larger than a critical value. The crucial energy separation Δ is obtained as a product of the transfer 'pathway' multiplied by coupling matrix elements at the gaps. It is shown that empty gaps are responsible for non-adiabatic behaviour and that saturated as well as aromatic parts of the protein permit electron transfer over larger distances than so far recognized. The Salemme model of the cytochrome c-cytochrome b_5 interaction may permit electron transfer if the 8.4 Å gap between the haem edges is filled by matter, for instance one of the propionate groups at the haem edge. Finally, the cytochrome c-cytochrome c peroxidase model of Poulos and Kraut is discussed and some alternative pathways suggested. (30 refs.)

117984 Exact second Born calculations for electron capture for systems with various projectile and target charges. J.H.McGuire, J.Eichler (Fachbereich Phys., Hahn-Meitner Inst., Berlin, Germany), P.R.Simony.
Phys. Rev. A (USA), vol.28, no.4, p.2104-12 (Oct. 1983).
Results of exact numerical calculations of differential and total 1*s*-1*s* electron-capture cross sections evaluated in the second Born approximation are presented for targets and projectiles of various charges Z_T and Z_P at velocities between 10 and 200 MeV/amu. For symmetric systems with $Z_P = Z_T = Z$ the Thomas peak in the differential cross section, characteristic of a free-wave second Born-approximation process, appears at velocities above $Z^2 \times$(5 MeV/amu), where Z is the nuclear charge of the target (or projectile). The shape of this Thomas peak contains information about real and virtual intermediate states of the system. For total cross sections at velocities below $Z^2 \times$(2 MeV) the second Born-approximation cross section is larger than the first Born-approximation cross section indicating a breakdown of the second Born approximation using the free-wave Green's function. Results using the peaking approximation of Drisko converge to the authors' exact second Born-approximation results only at velocities well above $Z^2 \times$(10 MeV/amu). For systems asymmetric in Z_P and Z_T no exact scaling is found, although the systematics are qualitatively similar to the symmetric case using $Z = {}^1/_2(Z_P + Z_T)$. For p+Ne at 100 MeV, the exact Born-approximation results lie somewhat above exact impulse-approximation calculations. It is found that the peaking approximation of Briggs and Simony converges to exact second Born-approximation results as the asymmetry of the projectile and target charges increases. At very high velocities the peaking approximation of Drisko also converges slowly to the exact second Born-approximation result. (28 refs.)

117985 Line emission from charge transfer with atomic hydrogen at thermal energies. G.A.Shields (Dept. of Astron., Univ. of Texas, Austin, TX, USA), A.Dalgarno, A.Sternberg.
Phys. Rev. A (USA), vol.28, no.4, p.2137-40 (Oct. 1983).
A list is assembled of the emission lines produced by the charge transfer of doubly and trebly charged ions of carbon, nitrogen, oxygen, and neon in collision at low energies with atomic hydrogen. Rate coefficients of 2.0×10^{-9}

$cm^3\ s^{-1}$ for the process $O^{3+}+H \rightarrow O^{2+}(2p3p,{}^1P)+H^+$ and of $2.1 \times 10^{-9}\ cm^3\ s^{-1}$ for the process $O^{3+}+H \rightarrow O^{2+}(2p3p,{}^3D_1)$ at 1 eV are obtained by comparing observations of planetary nebulae with detailed models. (45 refs.)

117986 Near resonance charge transfer from a laser excited donor state. V.S.Kushawaha (Dept. of Phys., Univ. of Missouri, St. Louis, MO, USA).
Z. Phys. A (Germany), vol.313, no.3, p.155-60 (1983).
A laser induced charge transfer from Na($3p$) to hydrogen-ions at different kinetic energies has been studied. An enhancement factor of about 90% in the production rate of Lyman-α radiation has been demonstrated to occur only with H^+ and Na($3p$) atoms reaction; no enhancement was observed with either H_2^+ or H_3^+ ions. Absolute cross-section for the production of Lyman-α radiation during the collision of H^+, H_2^+ and H_3^+ ions and Na($3p$) and Na($3s$) atoms have been measured in the energy range 1-600 eV. The charge exchange reactions involving hydrogen-ions and Na($3p$) atoms created by two different methods have also been compared. (29 refs.)

Analysis of proton-He resonances in very-low-energy collisions .... See Entry 117980

Atom-atom momentum-transfer cross section in the presence of resonances ...... See Entry 117981

34.80 ELECTRON SCATTERING

34.80B Elastic scattering of electrons by atoms and molecules

117987 Method of continued fractions with application to atomic physics. J.Horacek (Faculty of Math. & Phys., Charles Univ., Prague, Czechoslovakia), T.Sasakawa.
Phys. Rev. A (USA), vol.28, no.4, p.2151-6 (Oct. 1983).
A new iterative method for solving scattering integral equations for local as well as nonlocal potentials is proposed. The scattering matrix is expressed in the form of a continued fraction. This method converges extremely fast for compact potentials with arbitrary strength. A high precision of the result is expected with a relatively small amount of numerical work. Starting from the second iteration, all functions which are to be computed in the course of iterations are regular at the origin and are of finite range in configuration space. The method is applied to the elastic scattering of electrons from hydrogen atoms in the static, exchange approximation. Its efficiency is compared with some recently proposed methods. (12 refs.)

34.80D Atomic excitation and ionization by electron impact

117988 Threshold law for double ionization by positrons. P.Grujic (Inst. of Phys., Belgrade, Yugoslavia).
Fizika (Yugoslavia), vol.15, no.3, p.213-24 (July-Sept. 1983).
Threshold behaviour of the one-positron triple escape function has been studied within the classical theory. The ionization function energy dependence exponents χ are derived for a number of charges Z of residual ions: 2.966 ($Z=1$), 3.604 ($Z=2$), 4.011 ($Z=3$), etc. Also, the possibility for an experimental verification of the results obtained analytically is discussed. (13 refs.)

117989 Reaction (e^+,e^+e^-) as a development of the (e,2e) method. Yu.V.Popov, V.F.Erokhin (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Phys. Lett. A (Netherlands), vol.97A, no.7, p.280-2 (12 Sept. 1983).
The semiclassical method for the treatment of the post-interaction of outgoing electrons in (e,2e) symmetric processes suggested earlier for an explanation of the correct position of the maximum in angular correlation is generalized to an arbitrary case. At the same time the position of the peak of the triple differential cross section of (e^+,e^+e^-) reactions is predicted. This reaction can be a test to distinguish some models of (e,2e) reactions. (3 refs.)

117990 Cross sections for electron ionization of triply charged noble gases in the plane-wave Born approximation. E.J.McGuire (Sandia Nat. Labs., Albuquerque, NM, USA).
Phys. Rev. A (USA), vol.28, no.4, p.2091-5 (Oct. 1983).
Plane-wave Born-approximation calculations are presented for electron ionization of triply ionized noble-gas ions, and compared with recent experiment. Excellent agreement with experiment is found for Ne^{3+}, Ar^{3+}, and Kr^{3+}. The calculated cross section for ionization of Xe^{3+} is larger than the measurement by almost a factor of 2. The discrepancy is entirely due to the large cross section for excitation of the $(4d)^{10} \rightarrow (4d)^9(4f)$ transition followed by autoionization. It is suggested that configuration interaction will redistribute this transition with some strength transferred to exciting bound levels. (20 refs.)

117991 Resonance and intermediate-coupling effects in electron scattering with highly charged ions. I. Collision strength for Fe^{24+}, Se^{32+}, and Mo^{40+}. A.K.Pradhan (Dept. of Phys., Univ. of Windsor, Windsor, Ontario, Canada).
Phys. Rev. A (USA), vol.28, no.4, p.2113-27 (Oct. 1983).
A study of electron-impact excitation of highly charge ions in the helium isoelectronic sequence is reported. Nonresonant, intermediate-coupling collision strengths are computed for transitions up to and including the $n=3$ states. With the 13 fine-structure levels, i.e. $1s^2({}^1S_0)$, $1s2s({}^3S_1;\ {}^1S_0)$, $1s2p({}^3P_{0,1,2};\ {}^1P_1)$, $1s3s({}^3S_1;\ {}^1S_0)$, and $1s3p({}^3P_{0,1,2};\ {}^1P_1)$, there are 78 different inelastic transitions. Main calculations are carried out in the nine-state distorted-wave approximation including partial waves $l \leq 15$. Relativistic effects are taken into account in the Breit-Pauli approximation. Nine-state close-coupling calculations are also carried out for Fe^{24+} with $l \leq 4$ at a few energies for comparison (and for later work in paper II). Higher partial waves ($l > 15$) are treated by the Coulomb-Bethe method using accurate relativistic eigenenergies and oscillator strengths for the target ions. The Z dependence of the departure from LS coupling is investigated. Present results are in good general agreement with previous calculations where available, but some discrepancies are noted or clarified. Collision strengths are tabulated at energies from near the excitation energy of the $n=3$ complex to sufficiently high energies to enable rate coefficients to be computed. For transitions to the $n=3$ levels and for transitions where resonances are not important, the present values should yield reasonably accurate excitation rates (resonances are considered in paper II). The present data are required particularly for the analysis of observed spectra from high-temperature, high-density plasmas where the line intensities may depend on collisional redistribution among a number of excited $n=2$ and $n=3$ states. (22 refs.)

117992 Positronium formation in positron-helium scattering. P.Khan (Muralidhar Girls' School, Calcutta, India), A.S.Ghosh.
Phys. Rev. A (USA), vol.28, no.4, p.2181-9 (Oct. 1983).
The positronium-formation cross sections in positron-helium scattering have been calculated with the use of a distorted-wave polarized-orbital method from the threshold to 100 eV. The results with and without the matrix elements involving the distorted target wave functions are found to differ appreciably. The results of the first Born approximation are not expected to be correct even at the incident-positron energy 100 eV. The measured values at 20 eV are found to be less than $^1/_2$ of the present predicted values. The sharp rise of the formation cross section within the ore-gap region as observed by Charlton et al. (1980) has also been noticed by the authors. The minimum in the differential cross section has been found at all energies as in the case of hydrogen atom. (10 refs.)

Electron collisional rate coefficients for low-level transitions in hydrogen .... See Entry 117819

Influence of different collisional processes on the Stark broadening .... See Entry 117828

Resonance and intermediate-coupling effects in electron scattering with highly charged ions. II. Autoionization and dielectronic recombination .... See Entry 117840

Electron excitation rates among fine structure levels in O III .... See Entry 121523

34.80G Molecular excitation, ionization, and dissociation by electron impact

117993 Electron impact dissociation of simple molecules. Y.Hatano (Dept. of Chem., Tokyo Inst. of Technol., Tokyo, Japan).
Comments At. & Mol. Phys. (GB), vol.13, no.6, p.259-73 (1983).
A survey is given of recent experimental studies of the electron impact dissociation of simple molecules with emphasis on translational spectroscopy of dissociation fragment atoms by Doppler profile measurements of Balmer emission. The principle of experimental technique, the results and the discussion are summarized for H_2, D_2 and the molecules H_2O, HF, CH_4 and NH_3 in an isoelectronic sequence. Evidence has been given for the electronic structure of superexcited states and their dissociation processes. (46 refs.)

117994 Dissociative excitation of SiH_4, SiD_4 Si_2H_6 and GeH_4 by 0-100 eV electron impact. J.Perrin (Ecole Polytech., Palaiseau, France), J.F.M.Aarts.
Chem. Phys. (Netherlands), vol.80, no.3, p.351-65 (15 Oct. 1983).
The authors have measured emission cross sections of various electronically excited fragments produced by electron-impact dissociation of SiH_4, SiD_4, Si_2H_6 and GeH_4. At low impact energy (10-20 eV), the measured appearance potentials are correlated to specific dissociation processes. Below 22 eV superexcited states of SiH_4 play a dominant role in the formation of neutral excited fragments. In agreement with the results obtained on alkanes, the cross sections for fragment emission from Si_2H_6 are lower than those of SiH_4. On the other hand, the comparison of cross sections at 100 eV for fragment emission, dissociation and ionization on going from CH_4 to SiH_4 and GeH_4 shows an increase of the probability for production of neutral ground-state fragments at the cost of excited or ionic fragments. Both effects can be explained by a growing probability for internal conversion among the decay channels of superexcited states with increasing number of atoms or electrons in the parent molecule. For each molecule, the H Balmer-emission cross sections at 100 eV are proportional to n^{-b}, where $n \geq 3$ is the principal quantum number of the upper state of H and $3<b<5$ is a parameter characteristic of the parent molecule. Finally, a detailed analysis of the isotope effect between SiH_4 and SiD_4 on both fragment emission and ionization cross sections from 0 to 100 eV gives strong evidence of the competition between dissociation and autionisation in the decay of superexcited states. (41 refs.)

117995 Core level excitation of simple gases. A.Zhang, J.F.Morar, R.L.Park (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1461-4 (1983).
The ionization of simple gases by electron bombardment exhibits distinct resonances at electron energies slightly below the core level binding energies of the atomic constituents of the gas. A vacancy in an inner shell of the atom may recombine by a radiationless Auger process, thus leaving the molecule in a singly or higher ionized state. These ions are easily collected and the threshold resonances for excitation are evident in the second derivative of the ion yield plotted as a function of the energy of the electron beam. By using a mixture of gases, such as CO and CO_2, it is possible to measure relative chemical shifts of the C and O $1s$ thresholds. In this case the C $1s$ threshold is 3.9 eV lower in CO than in Co_2, and the O 1s threshold is 2.7 eV lower in CO than in CO_2. The authors discuss the feasibility of constructing a simple analyzer based on this technique to supplement conventional mass spectrometer analysis of gas composition. (11 refs.)

117996 Electron impact excitation of λ7990-Å multiplet. P.W.Erdman, E.C.Zipf (Dept. of Phys. & Astron., Univ. of Pittsburgh, Pittsburgh, PA, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.7245-9 (1 Sept. 1983).
The dissociative excitation of the atomic oxygen multiplet O I($3s'^3D^0 \rightarrow 3p^3P$; λ7990 Å) due to electron impact on O_2 and NO has been investigated. With O_2 as a target, no lines of this multiplet could be identified with a cross section greater than $2.4 \times 10^{-23}\ cm^2$ at 100 eV. Similar results were obtained for the excitation of NO, yielding an upper limit cross section of $1.1 \times 10^{-23}\ cm^2$. These results are consistent with a λ7990/λ989 branching ratio of $\sim 2.5 \times 10^{-5}$ that is at least an order of magnitude smaller than either the previous experimental upper limits or a recent theoretical calculation. This finding complicates the study of ($3s'^3D^0 \rightarrow 2p^4$ 3P; λ989 Å) radiation entrapment in the thermosphere and increases the potential importance of selective absorption of the λ989-Å multiplet by N_2. Although the latter process may help to explain some aspects of the behavior of λ7990-Å emission in aurorae, it is nonetheless difficult, in the light of the present results, to account for the observed absolute intensity of this infrared cascade transition using current entrapment models. (16 refs.)

117997 Energetics of the ionization and fragmentation of phosphorus oxyfluoride studied by electron-impact spectroscopy. O.Neskovic, M.Miletic, M.Veljkovic, D.Golobocanin, K.F.Zmbov (Boris Kidric Inst. of Nuclear Sci., Belgrade, Yugoslavia).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1341-6 (Sept. 1983).
The relative intensities and appearance energies of several positive ions in the mass spectrum of POF_3 are reported together with an ionization-efficiency curve for F^-, the only negative ion of significant intensity. Probable ion-fragmentation pathways are proposed together with the heats of formation of some positive ions and ionization energies for POF_2 and POF. The appearance energies of various electronic states of the observed ions have been

determined by deconvolution of the experimental ionization efficiency curves by the energy-distribution difference method. (19 refs.)

117998 **Electron-beam-induced emission of $KrXe^+$.** A.Luches, A.Perrone, A.Zecca (Dipartimento di Fisica, Univ. di Lecce, Lecce, Italy).
Opt. Commun. (Netherlands), vol.47, no.3, p.199-201 (1 Sept. 1983).
The emission of $KrXe^+$ was studied in Kr-Xe mixtures excited by an intense beam of fast electrons using time-resolved spectroscopy techniques. Previous work is discussed and the discrepancies are explained by noting that the emission band around 490 nm is affected by atomic transitions. Time constants and rate constants for the formation of the molecular ion are given. (12 refs.)

117999 **Density and temperature dependence of electron attachment to O_2 molecules in helium gas.** L.Bruschi, M.Santini, G.Torzo (Dipartimento di Fisica, Univ. di Padova, Padua, Italy).
Phys. Lett. A (Netherlands), vol.97A, no.7, p.286-8 (12 Sept. 1983).
The electron attachment frequency to O_2 molecules in dense helium gas shows a sharp peak at a temperature-dependent density N_p. The shape of the peak is simply related to the energy distribution function, and gives information on the tail states. (6 refs.)

Threshold law for double ionization by positrons ....See Entry 117988

Ionization mechanism in a nitrogen glow discharge ....See Entry 118788

34.90 OTHER TOPICS IN ATOMIC AND MOLECULAR COLLISION PROCESSES AND INTERACTIONS

118000 **Neutron scattering model for benzene.** F.Sefidvash (Nuclear Engng. Dept., Federal Univ. of Rio Grande do Sul, Porto Alegre, Brazil).
Atomkernenerg. Kerntech. (Germany), vol.42, no.3, p.191-2 (1983).
A theoretical model analogous to the Nelkin model for water for neutron scattering by protons bound in benzene is proposed. The physical model comprises a free translation of mass 78, a hindered rotational oscillator of effective mass 21.3 at an energy of 0.02 eV and two vibrational oscillators at energies 0.146 and 0.38 eV with masses of 1.62 and 3.09 respectively. The diffusion constant of 51000 cm^2/sec calculated by the model agrees well with the experimental value of (50360 ± 200) cm^2/sec. (9 refs.)

The use of transformation matrices to follow the change in electronic structure of some simple organic molecules upon ionization ....See Entry 117787

35.00 PROPERTIES OF ATOMS AND MOLECULES; INSTRUMENTS AND TECHNIQUES

35.10 ATOMS

An analytic approximation for the energy levels of neutral atoms ....See Entry 117749

35.10B Atomic masses, mass spectra, abundances, and isotopes

(inc. isotope separation; for mass spectrometry, see also 07.75; for radioisotope separation see 28.42H or 82.55)

118001 **Radiochemical isolation and radioactivity calibration of radium-228 by liquid-scintillation counting and gamma-ray spectrometry.** J.R.Noyce, J.M.R.Hutchinson (Center for Radiation Res., NBS, Washington, DC, USA), W.A.Kolb.
J. Radioanal. Chem. (Switzerland), vol.79, no.1, p.5-13 (1983).
Radium-228 was separated from aged thorium nitrate by liquid-liquid, two-phase, extraction and extensively purified, principally by ion-exchange chromatography. The radioactivity concentration of the purified radium-228 was measured by means of liquid-scintillation β-particle measurements of the ^{228}Ac daughter (corrected for progeny ingrowth). The results were confirmed by Ge(Li) well-detector intercomparison with radium-228 in equilibrium with its thorium-232 precursor which had been measured gravimetrically. Three hundred ampoules were provided to the US Environmental Protection Agency, Las Vegas, for distribution. (11 refs.)

Advanced isotope separation. Nuclear chemistry for the 21st century ....See Entry 117627

A drift chamber for the identification of slow particles ....See Entry 117729

Isotope separation in a low-pressure DC discharge ....See Entry 118790

35.10D Electric and magnetic moments, polarizability

g-factors for a spherical-top molecule ....See Entry 117774

The hydrogen atom in a magnetic field—symmetries in the low field diamagnetic limit ....See Entry 117813

Stark effect in barium $6snd$ $^1D_2$ Rydberg states; evidence of strong perturbations in the $^1F_3$ series ....See Entry 117831

Tensor hyperpolarizability of the $6s19d$ $^1D_2$ barium Rydberg state ....See Entry 117833

Effective cross section for depolarization of an alkali metal atom in a collision with an alkali halide molecule ....See Entry 117967

35.10F Relativistic corrections, fine- and hyperfine-structure constants

Triplet-singlet interaction in the $1s$ $2s^3S_1$ hyperfine splitting of He-like Li^+ ....See Entry 117804

Hyperfine structure splittings of the hydrogen atom in a covariant Hamiltonian formalism ....See Entry 117806

Magnetic resonance of cesium atoms in the case of optical pumping by radiation from a single-mode injection laser ....See Entry 117820

Isotopic shift measurement of the $^3P_1$-$^3P_0$ fine structure transition of ^{24}Mg and ^{26}Mg ....See Entry 117835

Angular distributions and quantum beats of photoelectrons from resonant two-photon ionization of lithium ....See Entry 117845

Resonance and intermediate-coupling effects in electron scattering with highly charged ions. I. Collision strength for Fe^{24+}, Se^{32+}, and Mo^{40+} ....See Entry 117991

Nonlinear plasma spectroscopy of the hydrogen Balmer-α line ....See Entry 118750

Electron excitation rates among fine structure levels in O III ....See Entry 121523

35.20 MOLECULES

(see also 61.55, 61.60, and 61.65 Specific structures of metals and alloys, of other inorganic materials, and of organic materials, respectively)

Syntheses and structures of the $[Fe^{III}(SPh)_4]^-$ and $[Fe^{III}(SEt)_4]^-$ anions. A general route to iron(III) tetrathiolate complexes ....See Entry 120605

35.20B General molecular conformation and symmetry; stereochemistry

118002 **PARST: a system of FORTRAN routines for calculating molecular structure parameters from results of crystal structure analyses.** M.Nardelli (Istituto di Chimica Generale e Inorganica, Univ. di Parma, Parma, Italy).
Comput. & Chem. (GB), vol.7, no.3, p.95-8 (1983).
Given a set of atomic positional and thermal parameters in a crystal defined by the unit cell constants and the space group symmetry operations, the title program calculates: (1) the Niggli reduced cell, (2) V, M, D_c, $F(000)$ and μ, (3) the orthogonal coordinates in Å, (4) the principal axes of the thermal ellipsoids together with U_{eq} and B_{eq}, (5) all bond distances, (6) all bond angles, (7) all torsion angles, (8) coordinates of hydrogen atoms in typical groups, (9) weighted least-squares planes or straight lines through given subsets of atoms and the angles they form, (10) ring puckering coordinates and displacement asymmetry parameters, (11) spherical polar coordinates for stereographic projections of atomic environments, (12) interatomic contacts between atoms of the given set and between these and symmetry related atoms, (13) geometrical parameters of possible hydrogen bonds, (14) transformed coordinates of pairs of atomic subsets to check the possible presence of pseudo-symmetries or to find the atoms responsible for the departure from symmetry, etc. (20 refs.)

118003 **Calculation of bond angles, lengths, and dihedral on a pocket calculator.** G.Herbert Caines, M.D.Johnston,Jr. (Dept. of Chem., Univ. of South Florida, Tampa, FL, USA).
Comput. & Chem. (GB), vol.7, no.3, p.99-102 (1983).
The method and software for calculating bond angles, bond lengths, and dihedral angles with an indication of (+) or (−) rotation is presented for the HP-67 calculator. Input coordinates are retained thereby eliminating duplicate re-input for similar calculations. (2 refs.)

118004 **Modifications to program SPACEFIL to produce shaded space-filling molecular models with perspective.** D.R.Henry (Dept. of Chem., Pennsylvania State Univ., University Park, PA, USA).
Comput. & Chem. (GB), vol.7, no.3, p.119-35 (1983).
Modifications to the program SPACEFIL are described, which allow the application of perspective transformations and atom shading to the space filling plots produced by the program. Other changes are described which allow the plotting of ORTEP-like ball and stick figures. (no refs.)

118005 **Conformation of N-substituted heterocycles with an endocyclic amide group. The effect of allylic strain.** B.Kurtev, M.Lyapova, S.Mishev, O.Nakova, A.Orahovats, I.Pojarlieff (Inst. of Organic Chem., Bulgarian Acad. of Sci., Sofia, Bulgaria).
Izv. Khim. Bulg. Akad. Nauk. (Bulgaria), vol.15, no.4, p.375-86 (1982). [received: Sept. 1983]
The conformation of the cis- and trans-isomers of 4,5-diphenyl-, and 5,6-diphenyl-tetrahydro-1,3-oxazine-2-one and 4,5-diphenyl-hexahydropyrimidine-2-one and of some of their N-substituted derivatives as well as the 1-methyl derivatives of 6-phenyl and trans-5,6-diphenyl-dihydrouracyl, have been studied by means of ^1H-NMR spectroscopy. Conformers with 4a, 6e, 4a, 5e and 5a, 6e phenyl group are preferred in the respective isomers of the N-H oxazionones confirming a half-chair conformation of the ring. Allylic strain caused by N-substituents shifts strongly the a, e⇄e, a equilibria in trans-4,6-diphenyl and cis-4,5-diphenyl-oxazinones and only moderately the e, e⇄a, a equilibria in the compounds with trans-vicinal phenyl groups. In the latter the diaxial conformation is preferred only in the case of bulky N-substituents. The diaxial conformation of trans-vicinal phenyl groups is most readily attained in the dihydrouracyl, less readily in the pyrimidone and least in the oxazinone system. (20 refs.)

118006 **Role of cations in the conformation of iota and kappa carrageenan.** I.T.Norton, D.M.Goodall (Dept. of Chem., Univ. of York, York, England), E.R.Morris, D.A.Rees.
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.10, p.2475-88 (Oct. 1983).
Cation binding to iota and kappa carrageenan has been investigated by IR spectroscopy, differential scanning calorimetry, optical rotation, intrinsic viscosity and light scattering. From measurements of the salt dependence of the midpoint of the thermally induced order-disorder transition the increase in the number of cations associated with each disaccharide unit was estimated. IR studies of sulphate stretching frequencies for the ordered conformation indicate that association of tetramethylammonium ions to carrageenan is by simple atmospheric binding. With K^+, by contrast, there is evidence of ion-pair formation, with stronger binding to kappa carrageenan than to iota. Enthalpy changes for the order-disorder transition support these conclusions. Comparison of intrinsic viscosity at high temperature in sodium or potassium chloride solution with values obtained in tetramethylammonium chloride solution indicate a less expanded conformation, consistent with a reduction in charge density by site binding of Na^+ and K^+, but not Me_4N^+. Binding constants were estimated from the variation in optical rotation of the disordered form with $[Na^+]$ and $[K^+]$. Light-scattering studies for segmented iota carrageenan in the high-temperature (disordered) conformation give radii of gyration for the Na^+ and K^+ salt forms which are close to the value calculated for an unperturbed random coil, while in tetramethylammonium chloride the radius of gyration is appreciably higher. (35 refs.)

118007 **Equilibrium and dynamic studies of the disorder-order transition of kappa carrageenan.** I.T.Norton, D.M.Goodall (Dept. of Chem., Univ. of York, York, England), E.R.Morris, D.A.Rees.
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.10, p.2489-500 (Oct. 1983).
The equilibria and dynamics of the transition from disorder to order in the polysaccharide kappa carrageenan have been investigated over a range of KCl

concentrations and temperatures. Kinetic observations can be explained by the following sequential mechanism for ordering of disaccharide residues following a salt-concentration jump: conformational change in disordered form $C^\circ \rightarrow C$, (II), dimerisation, $2C \rightleftharpoons H_2$, (III), aggregate formation $xC + yH_2 \rightleftharpoons (H_2)_{(1/2x+y)}$, (IV), where C indicates a random coil and H a helix residue. Reaction (III) was investigated quantitatively using a stopped-flow polarimeter, and the rate equation shown to be that of a second-order forward, first-order reverse equilibration, consistent with double-helix formation. Forward rate constants extrapolate to zero at the transition midpoint, as expected for a cooperative transition. Rate and activation parameters for helix nucleation in 0.50 mol. dm^{-3} KCl are $k_2(298K) = (9 \pm 1) \times 10^3$ dm^3 $mol.^{-1}$ s^{-1}, $\Delta H^* = 5 \pm 3$ kJ $mol.^{-1}$ and $\Delta S^* = -150 \pm 10$ J $mol.^{-1}$ K^{-1}. Parallels are drawn with polynucleotide double-helix formation, and in particular the low value of ΔH^* is consistent with a nucleation length of 1 or 2 disaccharides. A lower bound of 36 ± 3 disaccharides is estimated for the cooperative length from equilibrium and DSC data for the transition. (26 refs.)

118008 Dynamics of cation-induced conformational ordering in solutions of segmented iota carrageenan. I.T.Norton, D.M.Goodall (Dept. of Chem., Univ. of York, York, England), E.R.Morris, D.A.Rees.
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.10, p.2501-15 (Oct. 1983).
Optical-rotation and stopped-flow polarimetric studies of the salt-induced ordering of iota carrageenan segments have been carried out in tetramethylammonium, sodium and potassium chloride solutions over a range of temperatures and salt concentrations. Equilibrium and kinetic data accord with a cooperative dimerisation process, consistent with double-helix formation. The transition mechanism was further characterised by comparing the kinetics of reaction of fully disordered and partially ordered samples. The activation parameters for helix nucleation show that variations in ΔG^*_{298} are small, but changes in ΔH^* and ΔS^* with salt form and concentration (c) are substantial. Changes in the activation parameters at high $[Na^+]$ and $[K^+]$ correlate with increased flexibility of the disordered form due to a reduction in interchain electrostatic repulsion on ion-pair formation. (19 refs.)

Geometries of van der Waals complexes of small polar molecules .... See Entry 117743

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Ab initio study of rotational isomerism in cyclopropanecarboxaldehyde .... See Entry 117754

Structures and conformations of cyclopentane, cyclopentene, and cyclopentadiene .... See Entry 117757

Polarizability and aromaticity of pyrimidine: a comment .... See Entry 117758

The conformation of proline using the concept of pseudorotation .... See Entry 117760

Theoretical structure of the $B_2H_7^-$ anion .... See Entry 117765

Cli_5, CLi_6, and the related effectively hypervalent first-row molecules, $CLi_{5-n}H_n$ and $CLi_{6-n}H_n$. II .... See Entry 117767

Ab initio study of the vibrational spectrum and geometry of oxetane. I. Interpretation of the vibrational spectra .... See Entry 117772

Ground state structures of thiocyanogen and its cation .... See Entry 117775

Molecular fragmentations. XIV. Structures and energies of the mass spectral fragments derived from the methylphosphines .... See Entry 117781

Computer-assisted studies of hypolipidemic drugs .... See Entry 117782

Theoretical studies on conformational isomerism of bifurans and bipyrroles .... See Entry 117785

A comparison of the molecular orbital (ab initio, CNDO and EHT) methods applied to the conformational study of thiocarbonohydrazide in its basic and diprotonated forms .... See Entry 117786

The use of transformation matrices to follow the change in electronic structure of some simple organic molecules upon ionization .... See Entry 117787

Relativistic molecular structure calculations including CI for several low lying states of SnO .... See Entry 117793

Theoretical equilibrium geometry, vibrational frequencies and the first electronic transition energy of HCC .... See Entry 117799

Effective core potential calculations using frozen orbitals. Applications to transition metals .... See Entry 117814

X-ray and theoretical analysis of the relationship between substituent steric effects and the structure of bicyclo[1.1.0]butane. The unexpected flexibility of the bicylco[1.1.0]butane skeleton .... See Entry 117855

Collision induced rotational spectrum of allene .... See Entry 117873

A proton nuclear magnetic resonance study of purine and pyrimidine nucleoside 5′-diphosphates. Extent of macrochelete formation in monomeric metal ion complexes and promotion of self-stacking by metal ions .... See Entry 117890

Comparative structural study by dipole moments and NMR (^1H, 250 MHz) of dimethyl-6,6-cycloundecanones of carbon, silicon and germanium .... See Entry 117894

Electronic and magnetic properties of biliverdinate dimethylester metal(II) compounds $[M^{II}(BVDME)]$ ($M = Mn^{II}$, Co^{II}, Cu^{II}, Zn^{II}) .... See Entry 117928

Analytical molecular surface calculation .... See Entry 117950

The crystal and molecular structure of a reentrant nematogen: 4-cyanophenyl-3-methyl-4′-(4″-n-undecyloxy cinnamoyloxy)benzoate (11 CPMCB) .... See Entry 118877

Importance of steric effects in the isotropic phase of nematogenic compounds .... See Entry 118879

Orientational order of long-chain molecules in the nematic phase .... See Entry 118880

Geometric and electronic structural characterization of (3-cyano-4,5-dimethyl pyrrol-2-yl) oxamic acid ethyl ester using X-ray diffraction and ab initio quantum mechanics .... See Entry 118987

Influence of molecular structure on the low frequency dielectric relaxation of *p*-cyano-substituted liquid crystals in nematic solution .... See Entry 119981

Structure and reactivity of gas-phase ions: $C_4H_4^{+\cdot}$ .... See Entry 120604

35.20D Interatomic distances and angles

The relations between the valence angles of sp^3-hybridized central atoms for all possible local symmetries .... See Entry 117753

PARST: a system of FORTRAN routines for calculating molecular structure parameters from results of crystal structure analyses .... See Entry 118002

Calculation of bond angles, lengths, and dihedral on a pocket calculator .... See Entry 118003

Rigid-body motion of the $S_2O_3^{2-}$ group in thiosulphates .... See Entry 118014

35.20G Bond strengths, dissociation energies, hydrogen bonding, etc

118009 Dissociation energy of Li_2 molecule. R.R.Reddy (Dept. of Phys., KSRM, Coll. of Engng., Cuddapah, India), T.V.R.Rao.
Acta Phys. Pol. A (Poland), vol.A64, no.3, p.309-13 (Sept. 1983).
Experimental potential energy curve for the $X^1\Sigma_g^+$ state of Li_2 has been calculated using the method of Lakshman and Rao (1971). The dissociation energy of the ground state of Li_2 has been estimated to be 1.11 eV by the method of curve fitting using modified H-H function with the Lakshman and Rao's curve. The ionization potential of Li_2 molecule has been estimated to be 5.06 eV which is in good agreement with the value given by Huber and Herzberg (1979). (19 refs.)

118010 Bond strengths of organothorium and organouranium compounds. J.W.Bruno, T.J.Marks (Dept. of Chem., Northwestern Univ., Evanston, IL, USA), L.R.Morss.
J. Less-Common Met. (Switzerland), vol.93, no.2, p.357 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
Summary form only given, as follows. The dissociation energies of Th-C, Th-H and U-C bonds were determined in a series of compounds of the general formula $[\eta^5\text{-}C_5(CH_3)_5]_2MR_2$ where M is thorium or uranium and R represents hydrocarbyl, amide or hydride. Enthalpy data were obtained from heats of solution in toluene followed by heats of alcoholysis with tert-butanol in an inert gas batch titration reaction calorimeter. Calculated Th-R bond dissociation enthalpies range from 56 to 98 kcal mol^{-1}, decreasing in the order hydride $\gtrsim$amides$>$alkyls; corresponding U-R bonds are approximately 8 kcal mol^{-1} weaker. These results can be interpreted in terms of ligand geometry and the properties of the actinide ions. The data elucidate organoactinide reaction patterns involving C-H activation, cyclometallation, β hydride elimination and CO insertion.

118011 Proton affinities of GeH_4 and SiH_4. III. Calculations of proton affinity of GeH_4 in terms of a large basis set including polarization functions. S.Sudo, O.Nomura, S.Ikuta, S.Katagiri.
Rep. Inst. Phys. & Chem. Res. (Japan), vol.59, no.4, p.127-33 (1983). In Japanese.
Proton affinity of GeH_4 was calculated by using a large basis set which includes polarization functions, (i.e. f and p orbitals were used for Ge and H respectively). One hundred and thirty primitive GTOs in all were contracted to 90 CGTOs for GeH_5^+. For the species $GeH_5^+(Cs)$, $GeH_4(Td)$ and $GeH_3^+(D_{3h})$ all structural parameters were optimized by the three-point interpolation. The resulting proton affinity of GeH_4 was 7.12 eV, which is in good agreement with the observed value of 7.03 eV. By Mulliken population analysis of GeH_5^+, the authors obtained the AO population of f and p orbitals as follows: $N\{Ge(f)\} = 0.019$, $N\{H_{1,2,3}(p)\} = 0.008$, $N\{H_{4,5}(p)\} = 0.012$. (11 refs.)

118012 Wigner's phase space function and the bond in LiH. M.Springborg (Dept. of Chem., Tech. Univ. of Denmark, Lyngby, Denmark).
Theor. Chim. Acta (Germany), vol.63, no.4, p.349-56 (1983).
Wigner's phase space function of LiH is calculated and compared with the function for the system consisting of two non-interacting Li and H atoms. (17 refs.)

Parameterization of small basis set molecular orbital calculations for bond moment determination .... See Entry 117755

Tests of the orbital stasis and orbital following models .... See Entry 117756

Bonding effects on the momentum densities of alkaline-earth oxides .... See Entry 117768

Pseudopotential local-spin-density calculations for Si_2 .... See Entry 117770

Hydrogen-bond energies of FHF^- and $HOHF^-$. Ab initio studies of strong hydrogen bonds involving fluoride, using improved fluoride energies .... See Entry 117776

Calculation of the hydrogen molecule by means of a parametrization obtained from the hydrogen ion-molecule .... See Entry 117789

Conformational energetics in hydrogen-bonded dimers. The unobserved CO-HF complex .... See Entry 117796

Hydrogen bonding in excited states of pyridine and pyrazine .... See Entry 117798

Normal coordinate treatment of liquid water and calculation of vapor pressure isotope effects .... See Entry 117860

Infrared and nuclear magnetic resonance studies pertaining to the cage model for solutions of acetone in water .... See Entry 117867

Study of hydrogen bonds in carbohydrates from the fine structure of the ν(OH) band .... See Entry 117872

Evidence of intramolecular hydrogen bonding in a complex *N,N*-disubstituted formamide .... See Entry 117876

Determination of the dipole moment of thioformaldehyde in the $\tilde{a}\ ^3A_2$ excited state by laser phosphoresence excitation spectroscopy .... See Entry 117915

Angular distribution for the major photoelectron bands of nitrogen below 45 eV binding energy .... See Entry 117937

Comparison of photon-stimulated dissociation of gas-phase, solid and chemisorbed water .... See Entry 117942

Investigation of particularities found in intermolecular interaction for glycerine solutions with ordinary and heavy water through acoustic methods .... See Entry 117951

PARST: a system of FORTRAN routines for calculating molecular structure parameters from results of crystal structure analyses .... See Entry 118002

Role of cations in the conformation of iota and kappa carrageenan .... See Entry 118006

Molecular conformation of di-*o*-anisylcarbinol: an X-ray diffraction study .... See Entry 118988

Metal carbonyl bond strengths: applications of photoacoustic calorimetry .... See Entry 120651

35.20J Barrier heights (internal rotation, inversion); rotational isomerism, conformational dynamics

Ab initio study of rotational isomerism in cyclopropanecarboxaldehyde .... See Entry 117754

A CNDO/S-CI investigation of planar and orthogonal anisole .... See Entry 117778

Calculation of solvent and internal rotation effects on $^3J_{FH}$ and $^3J_{HH}$ spin-spin coupling constants in 1,2-difluoroethane .... See Entry 117783

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Effective core potential calculations using frozen orbitals. Applications to transition metals .... See Entry 117814

Measurement of the rotational barrier of a tetraalkylhydrazine radical cation . ... See Entry 117892

Packing and conformational contributions in binary liquid mixtures: acoustic studies of n-hexadecane with dimethylpentanes .... See Entry 118851

Dielectric relaxation processes of some dialkyl disulfides ...... See Entry 119975

35.20M Electric and magnetic moments (and derivatives), polarizability, and magnetic susceptibility

118013 Semi-empirical diamagnetic susceptibilities of cyclic β-ketoacetals. R.R.Gupta, M.Kumar (Dept. of Chem., Univ. of Rajasthan, Jaipur, India).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.297-9 (9 Sept. 1983).
Diamagnetic susceptibilities of cyclic β-ketoacetals have been calculated theoretically by wave-mechanical and semi-empirical approach. The wave-mechanical approach, however, gives due considerations to the contributions of all types of electrons but still, the agreement between experimental and theoretical values is not satisfactory. Semi-empirical approach in which diamagnetic susceptibility is considered to be contributed by atoms, bonds, and bond-bond interactions provided excellent results of diamagnetic susceptibilities irrespective of different structural environments present in these molecules and contributing considerably to the molecular diamagnetism. (12 refs.)

Ab initio study of rotational isomerism in cyclopropanecarboxaldehyde .... See Entry 117754

Parameterization of small basis set molecular orbital calculations for bond moment determination .... See Entry 117755

Tests of the orbital stasis and orbital following models .... See Entry 117756

Polarizability and aromaticity of pyrimidine: a comment .... See Entry 117758

Magnetic susceptibility of 1,1′,2,2′-tetramethylcobaltocene and 1,1′-diethylcobaltocene: evidence for the dynamic Jahn-Teller effect .... See Entry 117805

The electric dipole moment of the fluorocarbene radical, HCF, in its $\tilde{X}^1A'$ and $A^{\sim 1}A''$ electronic states .... See Entry 117827

Intracollisional interference in the pure rotational spectrum of HD: determination of the permanent electric dipole moment .... See Entry 117858

Solute-solvent interactions: nuclear relaxation of nitric oxide solutions in perfluoro solvents .... See Entry 117893

Comparative structural study by dipole moments and NMR (^1H, 250 MHz) of dimethyl-6,6-cycloundecanones of carbon, silicon and germanium .... See Entry 117894

Proton affinities of GeH_4 and SiH_4. III. Calculations of proton affinity of GeH_4 in terms of a large basis set including polarization functions .... See Entry 118011

Excess properties of binary solvent mixtures containing bromobenzene .... See Entry 119205

35.20P Rotation, vibration, and vibration-rotation constants

118014 Rigid-body motion of the $S_2O_3^{2-}$ group in thiosulphates. N.Armagan (Ankara Univ. Fen Fakultesi Fizik Bolumu, Ankara, Turkey).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.647-50 (1 Sept. 1983).
The recently published thermal parameters of Ba, Na, Mg, Ni, and NH_4 thiosulphates have been analysed for the rigid-body motion of the $S_2O_3^{2-}$ group using the **TL** and **TLS** treatments. In the cases of Ba, Na and NH_4 the rigidity of the group has been established and justified by employing various rigidity tests. Librational corrections to bond lengths have been found to be appreciable. For the cases of Mg and Ni the rigidity has been observed, but due to high ESDs detailed analysis has not been made. Hamilton's test has shown that the **TLS** treatment is preferable to the **TL** in all cases. (15 refs.)

118015 A method for predicting the anharmonicity constants $\omega_e\chi_e$ of halides of sodium. N.S.Murthy, N.S.Bapat, T.Manisekaran (Dept. of Phys., Univ. of Mysore, Mysore, India).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.4, p.381-3 (Oct. 1983).
A method is proposed for estimation of the vibrational anharmonicity constants $\omega_e\chi_e$ of diatomic molecules. The procedure involves fitting of the potential energy curve obtained by the RKRV method with that obtained by using the 5-parameter Hulburt-Hirschfelder potential function. The authors predicted values of $\omega_e\chi_e$ for alkali halides for which accurate data are not available. (10 refs.)

On determining the number of stochastic degrees of freedom in polyatomic molecules .... See Entry 117751

The formate anion: an ab initio study of its equilibrium structure, general harmonic force field and fundamental vibrational frequencies .... See Entry 117752

The conformation of proline using the concept of pseudorotation .... See Entry 117760

Ab initio study of the vibrational spectrum and geometry of oxetane. I. Interpretation of the vibrational spectra .... See Entry 117772

Compliant fields for water, ammonia, and methane .... See Entry 117777

Theoretical force field and vibrational spectrum of maleimide by the CNDO/2 force method .... See Entry 117779

Theoretical equilibrium geometry, vibrational frequencies and the first electronic transition energy of HCC .... See Entry 117799

Electric field gradient and force constant in nitriles .... See Entry 117850

Vibrational analysis of SiH_2F_2 and SiD_2F_2 .... See Entry 117853

Rotational perturbations in the $CN(B^2\Sigma^+-X^2\Sigma^+)$ tail band system. I. Analysis of the $v=27$ and 30 levels of $CN(A^2\Pi_i)$ .... See Entry 117854

X-ray and theoretical analysis of the relationship between substituent steric effects and the structure of bicyclo[1.1.0]butane. The unexpected flexibility of the bicylco[1.1.0]butane skeleton .... See Entry 117855

Methylpyridines: vibrational assignments and an approximate force field .... See Entry 117859

Normal coordinate treatment of liquid water and calculation of vapor pressure isotope effects .... See Entry 117860

The collision-induced far-infrared absorption band of gaseous methane in the region 30-900 cm^{-1} .... See Entry 117865

Raman spectroscopic studies on the vibrational relaxation of benzonitrile in benzene solution .... See Entry 117878

Raman spectra of araliphatic peroxides .... See Entry 117879

Rotational perturbations in the $CN(B^2\Sigma^+-X^2\Sigma^+)$ tail band system. II. Identification of the $CN(^4\Pi)$ state and its vibrational levels .... See Entry 117886

Millimeter wave spectroscopic studies of collision-induced energy transfer processes in the $^{13}CH_3F$ laser .... See Entry 118123

The emission spectrum of yttrium monoxide: new rotational and vibrational results on the $A^2\Pi$-$X^2\Sigma^+$ system .... See Entry 121524

35.20S Hyperfine and fine-structure constants

Study of hydrogen bonds in carbohydrates from the fine structure of the ν(OH) band .... See Entry 117872

Continuous tuning of the frequency of an NH_3 laser within the gain profile .... See Entry 118191

$OH(X^2\Pi)$ state distribution from HNO_3 and H_2O_2 photodissociation at 193 nm .... See Entry 120653

35.20V Ionization potentials, electron affinities, molecular core binding energy

A CNDO/S-CI investigation of planar and orthogonal anisole .... See Entry 117778

Electron affinity of para-benzoquinone by ab initio ΔSCF calculations and semiempirical estimation of electron correlation energy .... See Entry 117791

Relativistic and correlation corrections to electron affinities of alkali and halogen atoms .... See Entry 117803

Quenching of the fluorescence of substituted benzenes by halomethanes .... See Entry 117901

Calculation of vertical ionization potentials of chloroketene and dichloroketene by perturbation corrections to Koopmans' theorem using an effective core potential .... See Entry 117920

Vacuum ultraviolet photoelectron spectroscopy of transient species. XVI. The $NCO(X^2\Pi)$ radical .... See Entry 117926

Energetics of the ionization and fragmentation of phosphorus oxyfluoride studied by electron-impact spectroscopy .... See Entry 117997

35.20X Mass spectra

Molecular fragmentations. XIV. Structures and energies of the mass spectral fragments derived from the methylphosphines .... See Entry 117781

Ultraviolet and mass spectra of Schiff bases derived from 4,4-dimethyl-3-oxovaleraldehyde, acetylacetone and benzoylacetone .... See Entry 117885

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Structure and reactivity of gas-phase ions: $C_4H_4^{+\cdot}$ .... See Entry 120604

Time-of-flight mass spectrometry using multiphoton ionization and IR multiple photon dissociation: decomposition of the triethylamine cation .... See Entry 120650

35.80 ATOMIC AND MOLECULAR MEASUREMENTS AND TECHNIQUES

A deposition aid for matrix isolation studies .... See Entry 120262

36.00 STUDIES OF SPECIAL ATOMS AND MOLECULES

36.10 EXOTIC ATOMS AND MOLECULES (CONTAINING MESONS, MUONS, AND OTHER ABNORMAL PARTICLES)

Introduction to the chemistry of fractionally charged atoms: electronegativity .. .. See Entry 117433

Precision measurement of the magnetic moment of the Σ^- hyperon .... See Entry 117465

36.20 MACROMOLECULES AND POLYMER MOLECULES

(for biological macromolecules, see also 87.15; for polymer reactions and polymerization, see 82.35)

118016 Low-angle laser light scattering for determination of molecular weights—an inter-laboratory comparison. T.Dumelow, S.R.Holding, L.J.Maisey (Rubber & Plastics Res. Assoc., Shrewsbury, England).
Polym. Commun. (GB), vol.24, no.10, p.307-9 (Oct. 1983).
A round robin experiment was carried out to compare weight average molecular weight values for polymers obtained by several laboratories using low-angle laser light scattering. A low variation in results was found; also the study identified faults in some of the instruments used. (1 ref.)

118017 Hydrogen bond length and ^{1}H NMR chemical shifts in proteins. G.Wagner, A.Pardi, K.Wuthrich (Inst. fur Molekularbiologie und Biophys., Eidgenossiche Tech. Hochschule, Zurich-Honggerberg, Switzerland).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5948-9 (7 Sept. 1983).
The authors proposed novel NMR procedures for studies of the spatial structure of noncrystalline proteins (1982). In this scheme the initial structure determination relies primarily on measurements of intramolecular nuclear Overhauser effects between individually assigned hydrogen atoms. Subsequent refinements of the structure, however, depend further on correlations between additional NMR parameters and polypeptide conformation. The present communication reports on correlations observed between proton NMR chemical shifts and the length of intramolecular hydrogen bonds in a globular protein. Besides their potential usefulness for structure refinements these observations are of general interest because of the importance of hydrogen bonds in proteins. (14 refs.)

118018 Excuded volume effects in polymers attached to surfaces: chain conformational renormalization group. K.F.Freed (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.79, no.6, p.3121-32 (15 Sept. 1983).
The chain conformational space renormalization group method is extended to treat polymers with one or both ends attached to a wall. The theory is illustrated for the case of reflecting boundary conditions at the wall, but the methods for treating general boundary conditions are outlined. The fixed end-vector partition functions are evaluated both in the asymptotic scaling limit and in the cross-over regime where there is an explicit dependence on the strength of the excluded volume interaction. The mean square chain sizes transverse $\langle z^2 \rangle$ and parallel $\langle |\rho|^2 \rangle$ to the surface are evaluated separately to illustrate the use of the theory for the direct computation of these moments (including the prefactors) and the exponents. The calculations in these cases are far simpler than those required to determine the distribution functions. The prefactors display $\langle |\rho|^2 \rangle$ to be more spread out than $\langle z^2 \rangle$ which, in turn, as expected, is more spread out than $\langle \mathbf{R}^2 \rangle$ for a chain in free space. (29 refs.)

118019 Correction-to-scaling exponents and amplitudes for the correlation length of linear polymers in two dimensions. Z.V.Djordjevic, I.Majid, H.E.Stanley, R.J.Dos Santos (Dept. of Phys., Boston Univ., Boston, MA, USA).
J. Phys. A (GB), vol.16, no.14, p.L519-23 (1 Oct. 1983).
The authors consider the scaling behavior of the radius of gyration for a system of dilute linear polymers. They focus on ρ_N, the mean-square end-to-end distance of an N-step self-avoiding walk for which an additional two terms were recently calculated for the close-packed triangular lattice. Combining several extrapolation methods, they find that a consistent description of the scaling behaviour exists if and only if the correction-to-scaling exponent Δ is roughly half as large as commonly believed. They conclude that all data are consistent with the equation $\rho_N = AN^{2\nu}(1+B/N^{\Delta}+C/N)$ where $\nu = {}^3/_4$, $\Delta \simeq {}^2/_3$, $A \simeq 1/\sqrt{2}$, $AB \simeq 0.21$ and $C < 10^{-1}$. (21 refs.)

118020 Transition phenomena in polystyrene near the theta condition. C.Tsitsilianis, E.Pierri, A.Dondos (Dept. of Chem. Engng., Univ. of Patras, Patras, Greece).
J. Polym. Sci. Polym. Lett. Ed. (USA), vol.21, no.9, p.685-91 (Sept. 1983).
In recent years many works have appeared on conformational transitions of synthetic macromolecules. In all these studies the proposed explanation of the transition is a difference in mobility of the side groups of the chain, below and above the transition temperature. More precisely, it is accepted that at temperatures below the transition temperature there are strong interactions between side groups giving rise to a rather rigid and perhaps helicoidal structure. Above the transition temperature, rotations become easier, and the ridigity of parts of the molecules disappears. The authors present some viscosimetric results, obtained with linear and star-shaped polystyrenes, near the theta temperature. In this region, a new transition phenomenon is reported for this polymer (another transition has already been observed at higher temperature). (18 refs.)

118021 Cross-links in polyacetylene. C.T.White (Naval Res. Lab., Washington, DC, USA), P.Brant, M.L.Elert.
J. Phys. Colloq. (France), vol.44, no.C-3, p.443-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Suggests that cross-link formation during the cis to trans isomerization of polyacetylene can account for the unpaired electron spins in the trans-film. Results of self-consistent quantum chemical calculations that support and illustrate the basic ideas are reported. (4 refs.)

118022 Potential energy calculations on polyacetylene. E.Cernia, L.D'Ilario, G.Nencini (ASSORENI, Rome, Italy).
J. Phys. Colloq. (France), vol.44, no.C-3, p.447-50 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The results are presented of the potential energy calculations performed on the isolated chain of polyacetylene, as a function of the number of rotational degrees of freedom allowed to the chain, of the barrier height to the bond rotation, of the cis and trans configuration, of the molecular geometry and of the Van de Waals potential functions sets. The findings support the view of a conformation slightly distorted from planarity for the trans polymer, with possible conformational disorder within the chain, and of a 'dilution effect' of cisoidal units within trans sequences for the trans-cisoidal conformation. For the cis polymer a 'gauche' conformation is found to be likely the most stable one, with alignment of the double bonds belonging to succeeding helical turns whose distance is 3.3Å, giving rise to π-π intramolecular interactions. (14 refs.)

118023 Orientation of molecules of epoxide oligomers in a uniform stationary magnetic field. Yu.P.Rodin, Yu.M.Molchanov (Inst. of Polymer Mech., Acad. of Sci., Riga, Latvian SSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.715-18 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.1056-9 (Nov.-Dec. 1982). [received: Sept. 1983]
The experiment used epoxy resin ED-20, which was poured between two polyfluoroethylene resin films, 5 μm thick, fixed on a nonmagnetic holder. The holder was placed between the electromagnetic sockets of a strong field permeameter. After the magnetic action, whose maximal time was 20 min, the holder with the resin was placed in the measuring channel of a UR-20 infrared spectrometer, where by means of a polarizer, the absorption spectra of a magneto-treated resin were recorded at two positions. The degree of orientation of the molecule was determined from the value of the dichroic ratio. The analysis of the dependences obtained showed that the orientation of the EO molecules induced by a magnetic field was retained for a considerable time after switching off of the field. Thus, the epoxy resin treated in a magnetic field had the unique effect of a structural 'memory', which can be used in the preparation of composite materials from it. (11 refs.)

118024 Topological solitons and modulated structure of bases in DNA double helices: a dynamic plane base-rotator model. S.Takeno (Dept. of Phys., Kyoto Tech. Univ., Kyoto, Japan), S.Homma.
Prog. Theor. Phys. (Japan), vol.70, no.1, p.308-11 (July 1983).
Topological solitons and modulated structures of bases in DNA macromolecules are studied by using a dynamic plane-base rotator model. It is shown that there exist 2π topological solitons in the continuum approximation and metastable structures of bases, such as commensurate, incommensurate and chaotic structures. (7 refs.)

118025 Conformations of polymer chains grafted to unpermeable plane surface. T.M.Birshtein, E.B.Zhulina.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.9, p.1862-8 (Sept. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The system of long polymer chains grafted by one end of unpermeable plane surface has been studied by scaling method. The thermodynamic rigidity of grafted chains and quality of the solvent are taken into account. The diagram of the states and equilibrium characteristics of the system in each distinguished region of the diagram are determined. The influence of rigidity of macromolecules on the form of the diagram of the states is discussed. (13 refs.)

A focusing Weissenberg camera with multi-layer-line screens for macromolecular crystallography .... See Entry 117299

Turbulence induced change in the conformation of polymer molecules .... See Entry 118571

Cooperative programming in crystallography .... See Entry 118802

Analysis of anisotropy of small-angle neutron scattering of polyethylene single crystals .... See Entry 118822

Conformational and functional properties of haemoglobin in water+alcohol mixtures. Dependence of bulk electrostatic and hydrophobic interactions upon pH and KCl concentration .... See Entry 118849

Light scattering of solutions of polyamidohydrazide and conformational characteristics of its molecules .... See Entry 118861

Molecular geometry of cis- and trans-polyacetylene by nutation NMR spectroscopy .... See Entry 118916

Conformation of linear polymers in three dimensions .... See Entry 118917

Influence of molecular mass on the adsorption of oligobutadienes on oxidized carbon blacks .... See Entry 119331

Dynamical light scattering .... See Entry 120103

Cyclization dynamics of polymers. IX. The effect of polymer concentration on the slowest internal relaxation mode of a labelled polystyrene chain .... See Entry 120619

36.40 ATOMIC AND MOLECULAR CLUSTERS

118026 Theoretical study on the structure and stability of hydrogen-ion clusters H_n^+ and H_n^- (n=3, 5, 7, 9, 11, 13). K.Hirao (Dept. of Chem., Coll. of General Education, Nagoya Univ., Nagoya, Japan), S.Yamabe.
Chem. Phys. (Netherlands), vol.80, no.3, p.237-43 (15 Oct. 1983).
Ab initio SCF and CI calculations have been carried out for H_n^+ and H_n^- (n=3, 5, 7, 9, 11, 13) clusters with a double-zeta plus polarization basis set. The stabilization energy of negative ion clusters H_n^- is very small (less than 1 kcal) and their existence is critical. The structural difference between positive-and negative-ion clusters are discussed in terms of the bonding ability involved. While H_n^+ is a charge-transfer complex, the stability of H_n^- comes mainly from the ion-induced-dipole attractions. The electron correlation effect on the structure and stability of these ion clusters is also discussed. (15 refs.)

40.00 CLASSICAL AREAS OF PHENOMENOLOGY

(inc. applications)

41.00 ELECTRICITY AND MAGNETISM; FIELDS AND CHARGED PARTICLES

(see also 03.50 Maxwell theory: general mathematical aspects)

41.10 CLASSICAL ELECTROMAGNETISM

118027 Analogy of the Eshelby principle in the electrodynamics of inhomogeneous conducting media. A.K.Shidlovs'kii, A.F.Kovalevs'kii, V.F.Reztsov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.74-7 (1983). In Ukrainian.
An integral energy condition of the Eshelby type is deduced for inhomogeneous conducting media. The results obtained may be used for calculating total energy losses due to electrothermal heating of a two-dimensional medium with localized inclusions. (5 refs.)

118028 Gaussian beams: paraxial theory. G.A.Deschamps (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.745-66
A beam of electromagnetic radiation is a propagating field that remains substantially close to a central line called its axis. The transformation in such beams, either by propagation or reflection and refraction at some surfaces, is analyzed by using the paraxial approximation or replacing the wave equation by a parabolic equation. A central result is that Gaussian beams can be represented by pencils of complex rays and that consequently their transformations through optical systems obey the laws of geometrical optics as they apply to pencils of real rays. (26 refs.)

Stability of radiation-pressure particle traps: an optical Earnshaw theorem ....See Entry 118073

Classical derivation of the laser rate equation ....See Entry 118111

On the analysis of the force characteristics of the suspension of a cryogenic gyroscope ....See Entry 118387

41.10D Electrostatics, magnetostatics

118029 An approach to electrostatic interaction by using the elliptic functions. M.Agop (Inst. for Nuclear Power Reactors, Pitesti, Rumania).
Acta Phys. Pol. A (Poland), vol.A64, no.3, p.251-4 (Sept. 1983).
The influence of the electric quadrupole moment on a test charge is studied by using the elliptic functions in nonrelativistic approximation. (3 refs.)

118030 Variational formulation for the equilibrium condition of a conducting fluid in an electric field. N.Sujatha, P.H.Cutler, E.Kazes, J.P.Rogers (Dept. of Phys., Pennsylvania State Univ., University Park, PA, USA), N.M.Miskovsky.
Appl. Phys. A (Germany), vol.A32, no.2, p.55-61 (Oct. 1983).
The variational formalism is used to derive a set of equations describing the equilibrium configuration of a conducting fluid in an applied electric field. The validity of the variational equations is confirmed by application to the well-defined problem of concentric spherical electrodes. It is further shown that a cone, including the so-called Taylor cone used to model the equilibrium configuration of liquid metal ion sources, is inconsistent with the general equations. An analysis of the Taylor derivation suggests that reasons for the disagreement are the omission of the pressure difference term in the Laplace formula and use of only an approximate solution to the electrostatic cone problem. Finally a quasi-empirical method is suggested for the self-consistent solution of the variational equations. (10 refs.)

118031 Two-dimensional potential fields between sine-wave shaped electrodes. W.Reibetanz, M.Schilling, H.Liebscher (Tech. Hochschule Ilmenau, Ilmenau, Germany).
Wiss. Z. Tech. Hochsch. Ilmenau (Germany), vol.29, no.3, p.95-104 (1983). In German.
Analyses the potential field between electrodes which have either parallel gaps meandering in the form of sine waves, or sinusoidally varying gaps between a periodic surface and a flat surface. Analysis is carried out in successive narrow strips and it is concluded that relative field strength approaches a limiting value as gap width is increased and that the field strength modulation along the gap is small. Outputs from a simulation on a type EC1040 computer are appended. (7 refs.) *G.M.E.*

118032 Introduction to moment methods with simple applications. C.M.Butler (Dept. of Electrical Engng., Univ. of Mississippi, University, MS, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.3-55
The method of moments is introduced from a tutorial point of view and its application to integral equations is outlined. Methods for numerically solving simple integral equations from electrostatics are discussed, and numerical results are compared with analytical solutions in selected cases. The moment method is applied to problems of TM and TE illuminated cylinders and strips of infinite length as well as to that of wire antennas and scatterers. The presentation is introductory in nature and emphasizes basic techniques. (14 refs.)

41.10F Steady-state electromagnetic fields; electromagnetic induction

118033 Method of calculating electromagnetic and thermal fields in electrically conducting bodies during induction heating. G.S.Pisarenko, O.S.Tsibenko, O.M.Anisin.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.27-33 (1983). In Ukrainian.
A new numerical method is presented to study electromagnetic and heat fields. The method is based on nonlinear models of continuum mechanics and is applied to physical processes in different induction-heating systems. (8 refs.)

118034 Calculation of the levitation force using rare-earth permanent magnets. O.Podzimek.
Elektrotech. Obz. (Czechoslovakia), vol.72, no.8, p.440-1 (Aug. 1983). In Czech.
A simple mathematical analysis of a levitation system based on a current model of the magnet is presented and formulas for determining the forces acting within the levitation system are derived. Some experimental results reported in literature are also presented which indicate that the levitation systems using rare earth magnets are stable in the direction of the Z-axis. It is concluded that levitation systems described are constructionally simple but yield relatively large levitation forces. (1 ref.) *E.D.*

118035 Thermal limitation on the velocity of ring conductors in the case of induction axial acceleration. A.M.Baltakhanov, E.N.Ivanov.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.773-5 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR)*, vol.23, no.6, p.46-51 (Nov.-Dec. 1982). [received: Sept. 1983]
The authors consider the heating which occurs when a plane metal ring is accelerated in a two-dimensional pulsed magnetic field of a single-turn inductor. (7 refs.)

118036 Natural mode methods in frequency and time domain analysis. E.K.Miller (Lawrence Livermore Lab., Livermore, CA, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.173-212
Electromagnetic fields are described by second-order differential equations whose source-free solutions are exponential in the time domain. Their corresponding frequency-domain solutions are given by a series of poles in the complex frequency plane. This basic fact has led to the singularity expansion method (SEM) as a way to characterize both the transient and spectral EM fields of an object in terms of a set of common poles and residues. A condition necessary to implement the SEM is that a method must be available for finding the poles of the object. A number of techniques have been tested for obtaining the EM poles of antennas and scatterers. Prony's method is useful for not only computed or measured transient response data, but also, with slight modification, for spectral data as well. Its analytical development is outlined. Some introductory numerical results are given and its application is demonstrated for various types of data and objects. Use of poles for target identification from both transient and spectral data is considered. The discussion concludes with a demonstration of other ways in which poles can arise and be useful in electromagnetics, such as pattern synthesis and the one-dimensional inverse problem. (28 refs.)

118037 High-frequency fields excited by a line source located on a perfectly conducting concave cylindrical surface. T.Ishihara, L.B.Felsen, A.Green (Dept. of Electrical Engng., Polytech. Inst. of New York, Farmingdale, NY, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.721-44
Alternative representations are obtained for the high-frequency surface field excited on a perfectly conducting concave circular cylinder by an axial magnetic line current located on the surface. Included are ray-optical, canonical integral, whispering gallery mode, and near-field formulations, and various combinations of these. Asymptotic evaluations in different parameter ranges lead to results with varying accuracy and physical content. Their utility is assessed by extensive numerical calculations and comparisons. Most intriguing is a form of the asymptotic solution that involves only a number of geometric optical rays and a number of whispering galley modes. (10 refs.)

41.10H Electromagnetic waves: theory

118038 Note on a suggested formation of charge from an electromagnetic wave. W.H.McCrea (Univ. of Sussex, Brighton, England).
J. Phys. A (GB), vol.16, no.14, p.L574-51 (1 Oct. 1983).
Jennison has described an historic experiment in which he succeeds in bringing an electromagnetic wave to rest in the laboratory. It is here pointed out that the electrostatic field could not be produced by static charge in the laboratory; the concept of the formation of such charge from the original wave therefore appears to be somewhat misdirected. (1 ref.)

118039 On the propagation of electromagnetic waves in scattering stratified media treated by the Green's method. P.Croce (Inst. d'Optique, Centre Univ. d'Orsay, Orsay, France).
J. Opt. (France), vol.14, no.4, p.213-20 (July-Aug. 1983). In French.
The purpose of this work is to simply put forward the main features and essential results derived from previous papers written by the author on the propagation of electromagnetic waves in scattering stratified media. The methods used are compared with different related techniques described elsewhere. As a start point the following approximate problem which most simply illustrates these methods known as Green's methods is treated: effects on a conducting network of changes in admittance or electrical behaviour of its components. (17 refs.)

118040 Lines of circular polarization in electromagnetic wave fields. J.F.Nye (H.H. Wills Phys. Lab., Univ. of Bristol, Bristol, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1797, p.279-90 (8 Oct. 1983).
A monochromatic fully polarized electromagnetic wave propagating in free space possesses, in general, two families of singular lines ($\mathcal{C}$ lines) on which the transverse field is circularly polarized. The distribution of polarization ellipses around a $\mathcal{C}$ line shows that it obeys that same classification scheme as the isotropic points of a two-dimensional symmetric tensor: that is, a given section of a $\mathcal{C}$ line may belong to one of three different line patterns and it may be elliptic or hyperbolic. In addition it may be left- or right-handed. However, the way in which the polarization ellipses are executed in time shows that $\mathcal{C}$ lines may also be regarded as singularities of phase, analogous to line dislocations or interference fringes in scalar waves. From this point of view, a given line is of edge or screw type, according to its orientation, or, more generally, is a curved line of mixed edge-screw type. The whole field is divided into regions of opposite hand by surfaces $\mathcal{L}$ of linear polarization, and each family of $\mathcal{C}$ lines is confined to just one of these regions. (6 refs.)

118041 Low-frequency scattering by a perfectly conducting body. T.B.A.Senior (Radiation Labs., Univ. of Michigan, Ann Arbor, MI, USA).
Radio Sci. (USA), vol.17, no.4, p.741-6 (July-Aug. 1982). [received: Oct. 1983]
For a plane electromagnetic wave incident on a perfectly conducting body, the first two sets of terms in the low-frequency expansion of the far zone scattered field are derived. The first set consists of dipole contributions which can be expressed in terms of the electrostatic and magnetostatic potentials and the next set can be obtained from these same potentials plus one other. (12 refs.)

118042 Vector forward scattering theorem. M.A.Karam, A.K.Fung (Remote Sensing Lab., Univ. of Kansas Center for Res. Inc., Lawrence, KS, USA).
Radio Sci. (USA), vol.17, no.4, p.752-6 (July-Aug. 1982). [received: Oct. 1983]
The concept of energy balance is applied to compute the total loss (or extinction) resulting from a partially polarized plane wave impinging upon a scatter. It is shown that under the far-zone condition, the application of the stationary phase approximation leads to an expression relating the total loss to the Stokes parameters of the incident wave and the forward scattering amplitudes of the scattered wave. This relation may be referred to as the vector forward scattering theorem. For a linearly polarized incident plane wave, the result reduces correctly to the standard forward scattering theorem in the literature. (15 refs.)

118043 Approximate formulas for the fluctuation spectra of waves propagating in a turbulent medium. M.E.Gracheva, A.S.Gurvich (Inst. of Atmospheric Phys., Acad. of Sci., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.570-5 (July 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.791-6 (July 1982). [received: Sept. 1983]
The authors propose simple formulas for approximate calculation of the spectrum and dispersion of the intensity fluctuations in a plane monochromatic wave propagating in a turbulent medium where the fluctuations in the dielectric permittivity have a Kolmogorov spectrum. A numerical calculation with their proposed formulas is in satisfactory agreement with an accurate calculation of Gurvich et al. (1979) and with experimental data of Gurvich et al. (1975) and Gracheva et al. (1981). (12 refs.)

118044 Conditions for applicability of geometric diffraction theory. Yu.A.Kravtsov (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR), Yu.I.Orlov.
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.582-90 (July 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.805-14 (July 1982). [received: Sept. 1983]
Heuristic criteria are proposed for the applicability of geometric diffraction theory, based on the concept of diffraction-ray Fresnel volumes, i.e. regions essential for diffraction. The proposed criteria are reducible to the requirement that within the limits of the Fresnel volumes those quantities which are strictly constant in the original reference diffraction problem from which the diffraction coefficients are taken must be practically constant. Examples of the use of these criteria are presented and several related questions are considered—determination of fields in regions of nonapplicability of geometric theory, 'instability' of diffraction rays, choice of idealized diffraction models, etc. (22 refs.)

118045 Radiation of a charged filament within a moving diffuse boundary between two media. V.A.Davydov, V.V.Kolesov (Moscow State Univ., Moscow, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.591-5 (July 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.815-19 (July 1982). [received: Sept. 1983]
The radiation produced by a charged filament as the moving diffuse boundary between two media moves over it is considered. The cases of finite and infinite filament are analyzed, and expressions are obtained for the spectral and angular distributions of the radiant energy. (4 refs.)

118046 Interaction of electromagnetic waves in a classical superlattice. A.M.Belyantsev, V.I.Shashkin (Inst. of Appl. Phys., Acad. of Sci., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.606-12 (July 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.833-40 (July 1982). [received: Sept. 1983]
The interaction of electromagnetic waves upon propagation in an artificial dielectric of the classical superlattice type is investigated theoretically. It is shown that when waves propagate in such structures, effective parametric amplification of radiation of the millimeter and submillimeter wavelength regions and frequency conversion are possible. (12 refs.)

118047 Electromagnetic and acoustic resonance scattering theory. H.Uberall, P.J.Moser, J.D.Murphy, A.Nagl, G.Igiri, J.V.Subrahmanyam (Dept. of Phys., Catholic Univ., Washington, DC, USA), G.C.Gaungaurd, D.Brill, P.P.Delsanto, J.D.Alemar, E.Rosario.
Wave Motion (Netherlands), vol.5, no.4, p.307-29 (Aug. 1983).
The excitation of the eigenfrequencies of finite radar or sonar targets of inhomogeneities in elastic materials, of geological strata or of the entire earth by the impact of propagating waves (of electromagnetic or acoustic nature, or of ultrasonic, elastic or seismic character, respectively) manifests itself in the appearance of poles in the resulting wave amplitudes as described by the Resonance Scattering Theory. In the complex frequency plane, these poles relate to the ringing of the scattering resonances. In the complex mode number plane, corresponding poles are connected with circumferential or creeping waves. An analytic relation between these two descriptions is indicated, and a number of examples from the above-mentioned fields are discussed. The concepts of 'acoustic spectroscopy' and of 'radar spectroscopy' are introduced. (46 refs.)

118048 Present thinking on the use of the singularity expansion in electromagnetic scattering computation. L.W.Pearson (Dept. of Electrical Engng., Univ. of Mississippi, University, MS, USA).
Wave Motion (Netherlands), vol.5, no.4, p.355-68 (Aug. 1983).
While the singularity expansion of electromagnetic scattering responses has received a great deal of attention, a number of uncertainties has persisted in connection with its applicability and completeness. Recently, the dominant questions have been clarified, at least for one with pragmatic computational goals. The author surveys the present understanding of the singularity expansion from the pragmatist's point-of-view. Attention is given to recent work which clarifies points which have been debated in the past. The interpretation of the expansion in the presence of a time-limited excitation function is discussed. Various means for determining the expansion parameters for a given object are surveyed. (33 refs.)

118049 Parametric identification of transient electromagnetic systems. D.G.Dudley (Dept. of Electrical Engng., Univ. of Arizona, Tucson, AZ, USA).
Wave Motion (Netherlands), vol.5, no.4, p.369-84 (Aug. 1983).
Data into and out of a transient electromagnetic system are considered in the framework of modern system identification. System solutions that take the form of a complex exponential series are discussed. Since the identification of the parameters in the series is non-linear, emphasis shifts to the identification of the parameters in the difference equation whose solution is the exponential series. The subject is cast in the formalism of system identification with generalizations to more complex systems. Two examples are given, one involving an actual electromagnetic experiment. (23 refs.)

118050 Propagation constraints in the millimetre wavebands due to precipitation scattering. B.G.Evans, A.R.Holt (Univ. of Essex, Wivenoe Park, Colchester, England).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.23/1-10
Presents theoretically derived forward and backward scattering calculations for precipitation up to 210 GHz. Simple scaling rules are investigated for forward and backward directions which will allow scattering parameters at one frequency to be derived from other frequencies thus obviating the need for exhaustive and complex calculations. Predictions of propagation degradations for communication and radar systems operating in the millimetre wave bands are given. (13 refs.)

118051 Surface integral equations for conducting and dielectric bodies. R.F.Harrington, J.R.Mautz (Dept. of Electrical & Computer Engng., Univ. Syracuse, Syracuse, NY, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.97-116
The problems of electromagnetic radiation and scattering by conducting and dielectric bodies are discussed in terms of surface integral equations. It is shown that the usual H-field and E-field surface integral equations for conducting bodies fail to give unique solutions whenever the surface, when covered by an electric conductor, forms a resonant cavity. Two formulations which overcome this difficulty are the combined-field and combined-source formulations. It is shown that these two formulations always have a unique solution. Computations are given which serve to illustrate these theoretical predictions. (22 refs.)

118052 Aperture problems. J.Van Bladel (Lab. voor Elektromagnetisme en Acustica, Rijksuniv.-Gent, Ghent, Belgium), C.M.Butler.
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.117-72
The problem of apertures in a plane metallic screen provides a foundation for the study of the fundamental electromagnetic boundary value problems involving apertures or holes in conducting planar surfaces. The results are general in that they are also relevant for small apertures in curved surfaces (apertures in cavities and waveguides). The coupling between an abject and an aperture in a screen is also investigated. Integro-differential equations are formulated for the case of a perfectly conducting scatterer and an aperture, both of which are of arbitrary shape, with full account taken of the coupling between the aperture and the scatterer. The general equations are specialized to apertures and scatterers of interest, and selected data are presented. (45 refs.)

118053 Direct time-domain techniques for transient radiation and scattering-wires. E.K.Miller, J.A.Landt (Lawrence Livermore Lab., Livermore, CA, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.213-53
Provides a brief tutorial introduction to transient electromagnetics, focusing on direct time-domain techniques. Physical, mathematical, and numerical aspects of time-domain methods are examined with emphasis on wire objects excited as antennas or scatterers. Numerous computed examples illustrate the characteristics of direct time-domain procedures, especially where they may offer advantages over the more familiar frequency-domain techniques. These advantages include greater solution efficiency for many types of problems, the ability to handle nonlinearities, improved physical insight and interpretability, availability of wide-band information from a single calculation, and the possibility of isolating interactions among various parts of an object using time-range gating. (38 refs.)

118054 Time domain solutions via integral equations—surfaces and composite bodies. C.L.Bennett (Sperry Res. Center, Sudbury, MA, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.255-75
Discusses the time domain solution of scattering by conducting closed surfaces, open thin surfaces, surfaces with wires, and surfaces with fins. A brief description of the space-time integral equations that describe these problems is followed by a discussion of the marching on in time numerical solution procedure. Smoothed impulse responses for selected targets in these classes are presented, discussed, and compared with companion time domain measurements. Finally a description of the impulse response augmentation technique which yields an estimate of the impulse response is presented. (27 refs.)

118055 Inverse scattering. C.L.Bennett (Sperry Res. Center, Sudbury, MA, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.277-97
The inverse scattering problem, briefly stated, is to find the shape and constitutive characteristics of a scattering target when given the knowledge of the incident field and the resulting scattered field data. Over the past two decades interest has developed in the solution of the electromagnetic inverse scattering problem and, more recently, this interest has been heightened by the quest to develop target recognition techniques using radar. The author reviews progress in inverse scattering over the past two decades by describing a representative number of techniques that have been developed. The use of the physical optics or Kirchoff approximation as a basis for the solution of the problem is reviewed and discussed in both the time domain and in the frequency domain. 'Exact' techniques in the frequency domain that require knowledge of the far scattered field over a substantial portion of the enclosing sphere are considered. Next, 'exact' time domain techniques that are based on the time domain sequential solution of a space-time integral equation are described. Finally a description of techniques that are based on currently available radar observables such as radar cross section at multiple frequencies are presented. (30 refs.)

118056 On using isoperimetric inequalities and isoperimetric quotients in electromagnetic theory and applied physics. D.L.Jaggard (Dept. of Electrical Engng., Univ. of Utah, Salt Lake City, UT, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.319-41
Presents an alternative method of solving boundary-value problems. The method, based on certain isoperimetric inequalities, produces two-sided bounds on the value of physical quantities such as capacitance, aperture transmission coefficients, scattering cross sections, and the equivalent radii of wires. The results, which are valid in the low frequency regime, have the virtue of simplicity. In addition, these bounds show how the boundary must be altered to optimize the physical quantity under consideration. (31 refs.)

118057 Uniform theories of diffraction by edges. G.A.Deschamps (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.477-95
The geometrical theory of diffraction GTD has well known shortcomings when applied in some transition regions such as the vicinity of shadows boundaries or caustic surfaces. Uniform theories provide field descriptions valid in these regions. The author considers more specifically diffraction by the edge of a screen and describes and compares two competing theories that give the field near to shadow boundaries. (31 refs.)

118058 A uniform GTD for the diffraction by edges, vertices and convex surfaces. R.G.Kouyoumjian, P.H.Pathak, W.D.Burnside (Dept. of Electrical Engng., Ohio State Univ., Columbus, OH, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.497-561
When a radiating object is large in terms of wavelength, the scattering and diffraction are found to be essentially a local phenomenon associated with specific parts of the object, e.g. specular reflection, shadow boundaries, and edges. The high-frequency approach which the authors employ uses rays in a systematic way to describe this phenomenon. It was originally developed by Keller and his associates at the Courant Institute of Mathematical Sciences and is referred to as the geometrical theory of diffraction (GTD). The GTD is an extension of geometrical optics in which rays diffracted from edges, vertices and convex surfaces are introduced through a generalization of Fermat's Principle. In its original form, the GTD fails in the transition regions adjacent to shadow and reflection boundaries, to overcome this and other limitations in the GTD has resulted in the new uniform GTD (UTD) which provides expressions for the diffracted field so that the total high-frequency field is continuous at shadow and reflection boundaries. Uniform expressions have been found for electromagnetic fields diffracted from edges and vertices in perfectly-conducting surfaces and for the diffracted fields due to sources either on or off perfectly-conducting convex surfaces. (50 refs.)

118059 Introduction to GTD applications. H.Bach (Electromagnetics Inst., Tech. Univ. of Denmark, Lyngby, Denmark).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.563-94
Shows that whilst the application of the GTD to actual radiation problems is in principle simple, in practice the situation is not so straightforward due to a number of problems which can arise, such as; the necessity to solve ray tracing problems numerically, unknown diffraction coefficients and the fact that GTD breaks down in certain regions. The main advantage of a GTD solution is that it is valid for large scatterers ($d \gg \lambda$) where the Moment Methods often become unapplicable. Furthermore, GTD programs are fast programs and their speed of computation does not depend on size. The GTD is the natural tool, when high frequency antennas are placed in complex environments. The visual nature of the theory provides a clear physical insight into the effect of the scatterer upon the performance of the antenna and thus facilitates the design work in complicated practical cases. (6 refs.)

118060 GTD applications at LCT. F.A.Molinet (Lab. Central de Telecommunications, Velizy-Villacoublay, France).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.619-48
Among the GTD applications which have been treated in the last years at LCT, three topics have been selected and details are presented. The first topic concerns the development of a new hybrid method which combines the Moment Method with asymptotic techniques. The principle of this technique is outlined and discussed in the special case of the wedge problem. Numerical results are shown and compared with those obtained by other authors. The second topic concerns the application of GTD on bodies for which the following techniques are needed: asymptotic development of physical optics integrals, diffraction of creeping rays by edges, caustic corrections. The techniques used are briefly outlined and numerical results are presented and compared wih measurements. The third topic is devoted to the presentation of a general computer program for analyzing any kind of antenna mounted on an arbitrary structure consisting of plates, cylinders, spheres, cones. This analysis is accomplished by using GTD. Results obtained for antennas mounted on a satellite are given. (8 refs.)

118061 Transform approach to electromagnetic scattering. R.Mittra (Dept. of Electrical Engng., Univ. of Illinois, Urbana), Y.Rahmat-Samii, W.L.Ko.
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.649-95
For frequencies above the resonance region, the transform technique has been found useful for deriving efficient numerical solutions to radiation and scattering problems by combining integral-equation formulation with asymptotic techniques in the transform domain. Recent studies have shown that the scope of application can be considerably enlarged while simultaneously improving the efficiency of computation by incorporating the existing high-frequency asymptotic solutions into the solution procedure. Consequently, the authors focus mainly on this combination procedure which appears to offer the greatest potential for systematic and accurate solutions to radiation and scattering problems in the resonance region and above. (35 refs.)

118062 Some useful asymptotic and numerical techniques for solving high-frequency scattering problems. Y.Rahmat-Samii (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.697-719
The author's aims are firstly to conduct an analytical and numerical comparison among various widely used asymptotic theories in high-frequency electromagnetic diffraction and secondly to demonstrate the application of the Bessel-Jacobi series for the efficient and accurate evaluation of the radiation integral for offset reflector antennas. Only the basic concepts and final results are reported. (27 refs.)

118063 Evanescent waves. L.B.Felsen (Dept. of Electrical Engng., Polytech. Inst. of New York, Farmingdale, NY, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.767-77
The modal view of evanescent fields is unnecessarily restrictive. For nonevanescent fields it has long been recognized that modal representations are not the most useful formulations of certain field problems. Thus, in the range of short wavelengths in a free space or large-waveguide environment, ray-optical representations describe the field more compactly and with deeper physical content. Such ray-optical formulations are based on the local character of short-wavelength propagation and permit the tracking of fields in terms of local plane waves along ray trajectories that may intercept boundaries, scatterers, and other perturbations in the local propagation environment. Such local tracking is not possible for modal fields because of their inherent global character. The established versatility of ray (i.e. local wave tracking) methods for nonevanescent fields has motivated the study of similar methods for evanescent fields and the author reviews these developments. (17 refs.)

Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute .... See Entry 116932

Quantum scattering and scattering of electromagnetic waves by unbounded obstacles .... See Entry 117049

Introduction to moment methods with simple applications ..... See Entry 118032

Natural mode methods in frequency and time domain analysis .... See Entry 118036

High-frequency fields excited by a line source located on a perfectly conducting concave cylindrical surface .... See Entry 118037

The role of polaritons in superconductivity phenomenon [metal-dielectric contacts] .... See Entry 119467

Interference effects in detachment of surface electromagnetic waves from the edge of a metal substrate .... See Entry 120174

Transmission of electromagnetic radiation through ferromagnetic metals via oblique magnons? .... See Entry 120192

41.70 PARTICLES IN ELECTROMAGNETIC FIELDS: CLASSICAL ASPECTS

(inc. synchrotron radiation)

Finite-parameter solution classes for the two-body problem with delay .... See Entry 117005

41.80 PARTICLE BEAMS AND PARTICLE OPTICS

(see also 07.80 Electron and ion microscopy, 07.77 Beam handling equipment)

118064 The correct expression for the chromatic disc of confusion. J.Orloff (Oregon Graduate Center, Beaverton, OR, USA).
Optik (Germany), vol.65, no.3, p.263-5 (1983).
In order to calculate the properties of optical systems limited by the energy spread of a beam of charged particles, it is necessary to be able to accurately estimate the disc of confusion due to chromatic aberration. It is pointed out that an expression commonly used in electron microscopy is too large by a factor of 2. (4 refs.)

41.80D Electron beams and electron optics

118065 Statistical limitations in electron beam lithography. I. Theory. J.M.J.van Leeuwen, G.H.Jansen (Lab. voor Tech. Natuurkunde, Tech. Hogeschool Delft, Delft, Netherlands).
Optik (Germany), vol.65, no.3, p.179-207 (1983).
A discussion is given of the influence of the interactions between individual electrons on the beam qualities. The statistical and dynamical aspects of this many particle problem are reduced to a two particle problem. Boersch effect and trajectory displacement are calculated for a simple geometry with a narrow crossover. It is found that these statistical effects put a limit on the brightness of a beam and the dependence of this limiting brightness on the system parameters is made explicit. (11 refs.)

118066 Computer-aided calculation of the aberration coefficients of microwave cavity lenses. II. P.W.Hawkes (Lab. d'Optique Electronique, CNRS, Toulouse, France).
Optik (Germany), vol.65, no.3, p.227-51 (1983).
For pt.I see ibid., vol.63, p.129 (1983). A full list of the third-order spatial and temporal aberration coefficients of microwave cavity lenses is given, applicable for any frequency and electron energy. The spatial aberrations are considered only in the geometrical image plane but the temporal aberrations are given in a general plane. Nevertheless, sufficient details are provided to permit the reader to evaluate the spatial aberration coefficients in a general plane, the temporal image plane when this exists, for example, if required. (5 refs.)

On the optimal parameters of a cylindrical mirror analyzer .. See Entry 117291

Optical activity and rotary dichroism in light- and electron-optics .... See Entry 118072

41.80G Ion beams and ion optics

Third-order aberration-free ion-optical system for an electromagnetic isotope separator .... See Entry 117630

42.00 OPTICS

(for properties of gases and of liquids and solids, see 51.70 and 78. respectively; for atmospheric optics, see 92.65; for physiology of the eye, see 87.32)

42.10 PROPAGATION AND TRANSMISSION IN HOMOGENEOUS MEDIA

118067 Aspects of light scattering by spherical particles. L.E.Drain, N.Smith, W.Dalzell (Materials Phys. Div., AERE, Harwell, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.610-15 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Calculations of light scattering from transparent spherical particles under various polarization conditions have been made by the Mie theory with a view to assessing optical drop sizing techniques. Some interesting features revealed by detailed calculations are reported and illustrated by experimental observations. In forward scatter, there are fine details of the scattering pattern which are critically dependent on drop size. In back scatter, the intensity is found to be a rapidly varying function of particle diameter but under certain conditions of circular polarization, the scattering pattern is very regular and may be explained by a type of diffraction theory. (5 refs.)

118068 Rigorous diffraction theory applied to video disk geometries. J.H.T.Pasman (Philips Res. Lab., Eindhoven, Netherlands).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.674-80 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Briefly describes the principles of the recording and read-out of optical video discs, and presents a method to inspect pit geometries. The pit structure on the disc containing the video information is considered to act as a biaxial grating. It is shown that when continuous grooves are recorded on a disc, diffraction experiments give the dimensions of these grooves by comparing them to results of rigorous theory of diffraction by a finitely conducting uniaxial periodic structure with polygonal height profile. This measuring technique yields a precision of 3 nm in depth, 25 nm in width and 3° in slope. (11 refs.)

118069 Detection of hidden diffractors by coherence measurements. A.S.Glass, H.P.Baltes (Landis & Gyr Zug AG, Zug, Switzerland), K.M.Jauch.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.681-6 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The scattering of partially coherent radiation by structures such as diffraction gratings is analysed theoretically. The far-zone intensity and degree of coherence patterns are obtained in terms of relevant source parameters such as coherence length, beam width, phase curvature, and the properties of the diffracting structure. Particularly noteworthy is the fact that for relatively low source correlation lengths, far-zone coherence measurements can detect evidence of the diffracting structures even though the radiant intensity may be completely diffuse. This phenomenon has potential application to the coding and detection of optical information. Recent experiments do indeed corroborate these predictions. (15 refs.)

118070 Measurement of coherence of radiation from diffusely illuminated beam splitters. K.M.Jauch (Sodeco-Saia SA, Geneva, Switzerland), H.P.Baltes, A.S.Glass.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.687-90 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A variation of the Mach-Zehnder interferometric arrangement was used to show that both reversing and nonreversing wavefronts produce peaks of the coherent function in the far zone when a beam splitter (such as a semi-mirror or a grating) is illuminated by diffuse laser light. The reversing case produces a much narrower coherent angle than the non-reversing case, which, in turn, can be much narrower than the diffuse radiant intensity pattern. A beam splitter hidden behind such a diffuser and detectable only by means of a coherent optical setup has potential applications for optical coding. (11 refs.)

118071 Generalized dispersion relation for optical constants. K.-E.Peiponen (Dept. of Math. & Phys., Univ. of Joensuu, Joensuu, Finland).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.696-9 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A generalized dispersion relation is given which is not restricted by the demand of analyticity of the optical constant. Sum rules are also given with the aid of the generalized dispersion relation. (17 refs.)

118072 Optical activity and rotary dichroism in light- and electron-optics. P.S.Farago, R.M.Sillitto (Phys. Dept., Univ. of Edinburgh, Edinburgh, Scotland).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.702-14 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
When electron beams of low energy ($E<25$ eV (say) $\lambda>.25$ nm) pass through matter, effects should occur analogous to optical activity and rotary dichroism in light-optics. The possible effects are described, and are discussed on the basis of Born's explanation of dichroism; the opposite is expected in electron-optics. The possibility of observing these effects in electron-scattering from asymmetric molecules is discussed in relation to experiments, performed and proposed. (6 refs.)

118073 Stability of radiation-pressure particle traps: an optical Earnshaw theorem. A.Ashkin, J.P.Gordon (Bell Labs., Holmdel, NJ, USA).
Opt. Lett. (USA), vol.8, no.10, p.511-13 (Oct. 1983).
The authors prove an optical radiation Earnshaw theorem: a small dielectric particle cannot be trapped by using only the scattering force of optical radiation pressure. A corollary is that the gradient or dipole force is necessary to any successful optical trap. The authors discuss the implications of the theorem for recent proposals for the optical trapping of neutral atoms. (23 refs.)

118074 Synthesis of optical films during oblique incidence of light. A.G.Sveshnikov, A.V.Tikhonravov, S.A.Yanshin.
Zh. Vychisl. Mat. & Mat. Fiz. (USSR), vol.23, no.4, p.929-35 (July-Aug. 1983). In Russian. English translation in: *USSR Comput. Math. & Math. Phys. (GB)*
A general formulation of the problem of the synthesis of optical films is given for the case of the oblique incidence of plane electromagnetic waves. Necessary conditions for optimization are investigated. A method and an algorithm for the synthesis of such films are proposed and examples of synthesis carried out according to the program which has been developed are presented. (6 refs.) *A.G.C.*

118075 Introduction to geometrical optics. S.Cornbleet (Dept. of Phys., Univ. of Surrey, Guildford, England).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.423-37
The complete solution of a problem involving the interaction of an electromagnetic field with material bodies, has only been obtained exactly for a very few fundamental problems, where as some extremely complicated optical systems can be derived with comparative simplicity by geometrical methods. The procedure of recent times has become one of stretching both of the underlying concepts towards meeting and even of overlapping. This means including in the term 'geometrical optics' some concepts conventionally approached by EM theory and to evaluate some of the more intractable EM Problems by methods adopted from geometrical optics. This diffuses the boundary of what one calls geometrical optics considerably. One can have on one hand a geometrical optics theory of diffraction and obtain on the other hand an asymptotic EM solution in the geometrical optics limit. The author discusses Fermat's principle, conservation laws and the radiated field. (38 refs.)

118076 Foundations of the geometrical theory of diffraction. L.B.Felsen (Polytech. Inst. of New York, Farmingdale, NY, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.439-54
Discusses the ray method, equations for the ray-optical field and their solution, and asymptotic expansions. (4 refs.)

118077 Canonical problems and diffraction coefficients. P.L.Christiansen (Lab. of Appl. Math. Phys., Tech. Univ. of Denmark, Lyngby, Denmark).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.455-75
Introduces the theory of geometrical optics (GO) and the geometrical theory of diffraction (GTD). The solution of some canonical problems and extraction of GO and GTD scattering coefficients are considered. The scattering coefficients derived may be combined into hybrid scattering coefficients for complex processes. (4 refs.)

Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute .... See Entry 116932

A design of Raman spectrograph for optical activity and normal Raman measurements .... See Entry 117238

Gaussian beams: paraxial theory .... See Entry 118028

High-frequency fields excited by a line source located on a perfectly conducting concave cylindrical surface .... See Entry 118037

Inverse scattering .... See Entry 118055

Uniform theories of diffraction by edges .... See Entry 118057

A uniform GTD for the diffraction by edges, vertices and convex surfaces .... See Entry 118058

Probability density function of the intensity in partially polarized speckle fields .... See Entry 118081

Source encoding, signal sampling and spectral band filtering for partially coherent optical signal processing .... See Entry 118088

Image vignetting of the harmonic amplitude object .... See Entry 118091

Polarization holography for measuring photoinduced optical anisotropy .... See Entry 118095

Nonlinear reflection of elliptically polarized light .... See Entry 118201

Propagation of laser radiation in a moving delayed-response nonlinear medium .... See Entry 118202

Partially polarized planar sources that generate the same intensity distribution at the output plane .... See Entry 118239

Simple quasi-zoom with stable pupils .... See Entry 118242

Single material achromatic half-wave plate design .... See Entry 118251

Diffracting optics .... See Entry 118253

Emission of light from a strip waveguide with periodically varying parameters .... See Entry 118271

Birefringence and polarization mode dispersion caused by thermal stress in single mode fibers with various core ellipticities .... See Entry 118285

Monomode-polarization-maintaining fiber directional couplers .... See Entry 118290

Measurement of polarization mode coupling along a polarization-maintaining optical fiber using a backscattering technique .... See Entry 118291

Dependences of the polarization properties of polymer graded-index fibers of the Selfoc type .... See Entry 118294

Influence of the polarization of injection laser radiation on the efficiency of the acoustooptic interaction in anisotropic crystals .... See Entry 120022

Optical absorption and thermoluminescence of bismuth-doped NaCl single crystals irradiated with X-rays .... See Entry 120158

Biological aspects of light distribution in scattering media .... See Entry 120949

42.20 PROPAGATION AND TRANSMISSION IN INHOMOGENEOUS MEDIA

118078 Pseudoreversal contrast for speckle photography. M.Garcia, P.Mendez, J.M.Cuadrado (Dept. de Optica, Univ. Complutense, Madrid, Spain).
An. Fis. Ser. B (Spain), vol.79, no.2, p.85-9 (May-Aug. 1983). In Spanish. [received: Oct. 1983]
The effect of 'pseudoreversal contrast' when the various speckle patterns are recorded on the same photographic plate with a small displacement of the plate between the exposures is analyzed. A interpretation is proposed and experimental confirmation given. (7 refs.)

118079 Modified Monte-Carlo method to evaluate multiple scattering effects on lightbeam transmission through a turbid atmosphere. P.Bruscaglioni, A.Ismaelli, G.Zaccanti (Istituto di Fisica Superiore, Univ. di Firenze, Firenze, Italy), L.Pantani.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.164-73 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A modified Monte-Carlo method is presented, suitable for evaluating the contribution of different orders of scattering to the power transmitted through a turbid atmosphere. The results of numerical calculations performed by using scalar scattering functions are also shown. (7 refs.)

118080 Eikonal approximation to small angle light scattering from absorbing fibres. S.K.Sharma, D.J.Somerford (Dept. of Phys., Univ. Coll. Cardiff, Cardiff, Wales).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.532-7 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The eikonal and other approximation methods used to describe light scattering are compared with the exact theory for long absorbing fibres. Fibre diameters in the range 0.2-4.0 μm are considered. The real and imaginary refractive index values considered are 1.05, 1.10, 1.15 and 0.001, 0.01, 0.1, 1.0 respectively. The implications of these results to fibre sizing are discussed. (13 refs.)

118081 Probability density function of the intensity in partially polarized speckle fields. P.F.Steeger (Univ. Essen Gesamthochschule, Fachbereich Phys., Essen, Germany).
Opt. Lett. (USA), vol.8, no.10, p.528-30 (Oct. 1983).
A partially polarized speckle pattern is regarded as a superposition of two linearly polarized speckle patterns. The probability density function of the intensity is analytically calculated from the bivariate Rayleigh distribution. The resulting formula is compared with previous results. The negative exponential distribution is derived for a partially polarized speckle field. This result is experimentally verified. (4 refs.)

Theory of the passage of particles and waves through randomly inhomogeneous media .... See Entry 117129

On virtual fringe analysis method in focused double-exposure speckle photography .... See Entry 117219

Speckle in confocal scanning optical microscopes .... See Entry 117227

Calculation of surface-scattered optical fields in designing optical scanning devices .... See Entry 120556

Correlation and interferometric light scattering studies of the lens of the eye .... See Entry 120841

Scintillation of laser radiation due to propagation through atmospheric turbulence, measurements, and theoretical calculations .... See Entry 121370

Optical properties of interplanetary dust: comparison with light scattering by larger meteoritic and terrestrial grains .... See Entry 121594

42.30 OPTICAL INFORMATION, IMAGE FORMATION AND ANALYSIS

118082 Controlled transparencies in information-processing systems. A.A.Berezhnoi, Yu.V.Popov.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.41-8 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1603-13 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
Problems of application of controlled transparencies in optical systems for processing two-dimensional signals are considered. The problems discussed are illustrated with graphs and sample anisotropic records of images in electrooptical crystals. A summary table of comparative technical characteristics of controlled transparencies is included. (24 refs.)

118083 Acquisition and manipulation of image statistics. A.Canas (Optics Section, Blackett Lab. Imperial Coll., London, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.98-103 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The basic concepts of image histogram modification are described, including in particular the technique of histogram equalisation or flattening, which is the basis for a large variety of transformations. A fast and versatile digital system is described which is capable of acquiring image histogram data, and under microprocessor control, of performing many transformations interactively. Images are input in the form of standard TV rate video signals and processed with <150 ns throughput delay. Transformation calculations are performed in well under a second. (1 ref.)

118084 Hybrid optical-digital image processing system for pattern recognition. F.Merkle, T.Lorch, T.Karte, J.Donandt (Inst. of Appl. Phys., Univ. of Heidelberg, Heidelberg, Germany).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.450-8 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The coherent optical filtering techniques provide a general concept for the classification of patterns. The authors describe the design and testing of a hybrid optical-digital image processing system and the development of methods for a statistical expansion of the correlation signal shape because a simple correlation signal intensity measurement is in most of the applications insufficient. Six different algorithms for correlation signal evaluation are investigated. A feature reduction is achieved by a multivariate analysis. For alpha-numeric patterns modified by binary random noise, rotation, scaling and shearing high classification results have been obtained. (15 refs.)

118085 Application of Winograd's fast Fourier transform (FFT) to the calculation of diffraction optical transfer function (OTF). D.Hashmaty-Manesh, S.C.Tam (Blackett Lab., Imperial Coll. London, London, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.692-5 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Since the advent of the Cooley-Tukey FFT algorithm, many optical designers who have used the method to compute the optical transfer function with desk-top computers would welcome the availability of even faster algorithms. There has, of course, been a steady improvement in FFT techniques in the past decade or so, but it seems that Winograd's algorithm is the most encouraging yet. The authors report on the application of this new algorithm to OTF calculation and compare it with some other methods of computing the OTF. (5 refs.)

118086 On the possibility of solving the boundary problem of the three-dimensional Poisson equation using a coherent optical processor. V.G.Pisarenko.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.56-9 (1983). In Ukrainian.
A computation method is suggested to construct an approximate solution to a three-dimensional boundary-value problem for the Poisson equation in a stratified medium. A circuit of a coherent optical processor implementing this method is presented. (4 refs.)

118087 Optical encrypting system. P.Callens (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.3B, p.1533-4 (Aug. 1983).
The author describes a process for encrypting a typed text through double reflections on two sets of mirrors. (no refs.)

118088 Source encoding, signal sampling and spectral band filtering for partially coherent optical signal processing. F.T.S.Yu (Dept. of Electrical Engng., Pennsylvania State Univ., University Park, PA, USA).
J. Opt. (France), vol.14, no.4, p.173-8 (July-Aug. 1983).
Relations between coherence requirement, spectral filtering, signal sampling, and source encoding are discussed. Since the spatial coherence requirement is determined by the signal processing operation, a strict spatial coherence is usually not required. The advantage of the source encoding is to relax the constraints of a physical light source so that the signal processing can be carried out with an extended incoherent source. The effect of signal sampling is to improve the temporal coherence requirement at the Fourier plane so that the spatial filtering can be carried out with a partially coherence mode. The objective of broad spectral band filtering is to carry out the signal processing over the entire spectral band of the light source so that the coherent noise can be eliminated. Since the partially coherent optical processor utilizes a broad spectral band white-light source, it is particularly suitable for color signal processing. Experimental demonstrations for the source encoding, signal sampling and spectral band filtering are included. (8 refs.)

118089 Effect of figure and waviness on image quality. J.P.Marioge, S.Slansky.
J. Opt. (France), vol.14, no.4, p.189-98 (July-Aug. 1983).
Optical surfaces have been produced for generations by a grinding process. For a few decades, new surfacing methods have been applied to obtain spherical surfaces, but more often aspherical ones. They produce very different defects. The machinings are carried out by a computer process, controlling the position of the tool, and one must particularly beware of deformations due to the fastening on the spindle and of the waviness and undulations of the surface. The authors studied the change of an image when optical surfaces near the pupil of the lens show waviness of various periods. The first computation defines the ratio of the energy diffracted outside a circle of a given radius to the total energy emitted by the diffracted pattern. The development of the image of extended objects is studied for the image of a field edge and the image of a sine grating (transfer function). (7 refs.)

118090 The use of normal equations for superresolution problems. H.Maitre, A.J.Levy (Lab. Image, Ecole Nat. Superieure des Telecommunications, Paris, France).
J. Opt. (France), vol.14, no.4, p.205-7 (July-Aug. 1983).
In an algebraic approach, a superresolution problem is to be seen as a linear system of equations, with constraints. The authors discuss the advantages of using normal equations $D^t g = D^t f$ instead of $g = Df$ for the reconstruction of diffraction limited images on a computer, taking into account practical problems of ill-condition, noise and computer accuracy. (8 refs.)

118091 Image vignetting of the harmonic amplitude object. M.Rataj (Inst. of Design of Precise & Optical Instruments, Warsaw Tech. Univ., Warsaw, Poland).
Optik (Germany), vol.65, no.3, p.253-61 (1983).
Demonstrates vignetting effects using the wave optics approach. Different possible cases of the image vignetting are considered and the image vignetting of the harmonic spatial frequencies created in the object is pointed out as the special case of the general vignetting phenomenon. (4 refs.)

118092 Character recognition: a new multiple filter. C.Ferreira, P.Andres, E.Bonet, A.Pons, M.Aguilar (Dept. de Optica, Univ. de Valencia, Valencia, Spain).
Opt. Commun. (Netherlands), vol.47, no.3, p.177-82 (1 Sept. 1983).
A multiple filter obtained with only one exposure is proposed for character recognition by means of correlation filtering. The filter is obtained by Fourier holography from a transparency in which the different characters are matched to a determined angle among them. (19 refs.)

118093 Limit of continuous and discrete finite-band Gerchberg iterative spectrum extrapolation. C.L.Byrne (Naval Res. Lab., Washington, DC, USA), D.M.Wells.
Opt. Lett. (USA), vol.8, no.10, p.526-7 (Oct. 1983).
It is known that the Gerchberg method for iteratively extrapolating the spectrum of an object of finite support has a different limit when the infinite frequency band used in the iterations is replaced by a finite one. It is shown that, for both continuous and discrete data, this limit involves an optimal extrapolation within the finite band to minimize the component of the limit that lies beyond the object support. (8 refs.)

SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82 .... See Entry 116913

Born, the innovator .... See Entry 116945

Role for automatic fringe analysis in optical metrology .... See Entry 117221

Studies on optical properties of confocal scanning optical microscope using pupils with radial transmission ρ^n distribution .... See Entry 117232

Detection of hidden diffractors by coherence measurements .... See Entry 118069

Dynamic optical cross-correlator using a liquid crystal light valve for real time data input .... See Entry 118096

Construction of a two-dimensional colour hologram using a source encoding technique .... See Entry 118104

TeO_x thin films for an optical disc memory .... See Entry 118237

Compact infrared continuous zoom telescope .... See Entry 118243

Elect-equimultiple imaging with stacked distributed-index planar microlenses .... See Entry 118244

The Mangin mirror as imaging element .... See Entry 118245

Collimator with simulated eye aberrations for use in measuring the modulation transfer function (MTF) of telescopes and binoculars .... See Entry 118250

Diffracting optics .... See Entry 118253

Applications of interference coatings in optical processing .... See Entry 118255

CGH filters for coding and decoding dilute objects .... See Entry 118256

Tunable bandstop filter for binary objects: a self-imaging technique .... See Entry 118259

Fiberoptic communications. Status and prospects for development .... See Entry 118275

The geometric and Fourier transform solutions for the object-image conjugated interference field of human retina in the visual acuity examination by laser interferometry .... See Entry 120842

Possible optical design of a telescope with a spherical main mirror 20-24 m in diameter .... See Entry 121530

Computation of the profile of a surface accurately corrected for spherical aberration on the axis in a centered optical system .... See Entry 121538

42.40 HOLOGRAPHY

(for acoustic holography, see 43.63)

118094 Present status of holographic laser beam dynamic correction methods. M.S.Soskin, A.I.Khizhnyak (Inst. of Phys., Acad. of Sci., Ukrainian SSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.27-32 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1585-92 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
The widespread use of lasers in science and engineering makes control of the spatial structure of their beams a particularly urgent problem. There are several possible approaches to its solution. The authors investigate the holographic approach in which attention is concentrated on problems of obtaining laser beams with small angular divergence. (49 refs.)

118095 Polarization holography for measuring photoinduced optical anisotropy. T.Todorov, L.Nikolova, N.Tomova, V.Dragostinova (Central Lab. of Optical Storage & Processing of Information, Bulgarian Acad. of Sci., Sofia, Bulgaria).
Appl. Phys. B (Germany), vol.B32, no.2, p.93-5 (Oct. 1983).
A new experimental method for measuring the optical anisotropy induced at photochemical reactions is proposed. The method is based on polarization holography and is a zero-background high sensitive technique. It is used to measure the molecular dichroism of fluorescein and the birefringence induced at the additional photopolymerization of PMMA. (9 refs.)

118096 Dynamic optical cross-correlator using a liquid crystal light valve for real time data input. B.Loiseaux (Lab. Central de Recherches, Thomson-CSF, Orsay, France), L.Pichon, G.Illiaquer, J.P.Huignard.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.467-72 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Coherent optical processors have interesting potential applications for pattern recognition or optical computing. A real-time cross-correlator using the dynamic holographic properties of $Bi_{12}SiO_{20}$ (B.S.O.) crystals is presented. A photo-conductor liquid crystal light valve transducer allows a real-time data input in the processor via incoherent to coherent light conversion. A classical two-lenses optical configuration is used to simultaneously record and read the dynamic phase-volume hologram photoinduced by the photorefractive B.S.O. crystal placed in the focal plane of the Fourier transform lens. Some specific properties of the dynamic correlator such as cycle time constant, spatial resolution and beam intensities are reported. Experimental cross-correlation results of various types of information written on the light valve are demonstrated. (17 refs.)

118097 Pulsed holographic nondestructive testing on aircraft. H.Fagot, P.Smigielski, F.Albe (Inst. Franco-Allemand de Recherches de Saint-Louis, Saint-Louis, France), J.-L.Arnaud.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.493-6 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A holographic camera composed of two ruby lasers was built at ISL. It provides double exposure holograms with an adjustable time interval ranging from few ns to infinity. Various aircraft structures were first tested at ISL in laboratory conditions: honeycomb panels, wings ... The industrial tests on a military aircraft in maintenance checking were performed in a hangar of the SNIAS at Saint-Nazaire: wings, trap-door of the rear landing gear, air-brake ... Electromechanical shocks were used to make the structure vibrate and to allow a fast trigger of the lasers. This avoids disturbance due to ambient noise and vibrations. (5 refs.)

118098 Real and nonreal time holographic nondestructive test (HNDT) for painting diagnostics. S.Amadesi, A.D'Altorio, D.Paoletti (Istituto di Fisica Tecnica, Univ. di L'Aquila, L'Aquila, Italy).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.497-501 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A holographic nondestructive test procedure as a diagnostics tool in art conservation and preservation of ancient wooden panel paintings is presented. A brief discussion of the reliability of the method is given. Some examples of experimental results are reported; they show that the defects can be detected in real and nonreal time on laboratory models, at varying depths, through ambient drift. The examination is made combining sandwich holography and real time holography, without any modification of holographic set up. (4 refs.)

118099 Measurement of curvature and bending stiffness of thin carbon composite plates using holographic interferometry. M.Marchant, M.B.Snell (Structures Dept., Royal Aircraft Establ., Farnborough, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.502-9 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Holographic interferometry has been used to measure the deflection of thin CFRP cross-ply plates under very small pure bending loads. The authors describe the design and calibration of the optical system, the method of mounting and loading the specimen, and the computation of curvature values from the fringe data, together with a brief section on the subsequent derivation of the bending stiffness. Results obtained, both for the composite material and for a control plate of aluminium alloy, are shown to be in good agreement with theory, and further applications to thick plates and those of unknown construction appear feasible. (no refs.)

118100 Multifocal holographic optical components. A.M.P.P.Leite (Phys. Dept., Univ. of Porto, Porto, Portugal).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.638-42 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Complex multifocal holographic lenses can be recorded in a single plate. Performance in accordance to each individual optical element function can be chosen through proper illumination of the plate. The basic aspects involved in their performance are reviewed and experimental results presented. (15 refs.)

118101 Some characteristics of and measurements on dichromated gelatin reflection holograms. R.A.Cullen (Optics Section, Imperial Coll. London, London, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.647-54 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Dichromated gelatin is known to be a useful photosensitive holographic recording material. The author investigated some characteristics of dichromated gelatin, with particular attention to the diffraction efficiency (typically 95-98%), reflection bandwidth and incident angle sensitivity. The dichromated gelatin preparation and processing techniques that affect these parameters are included. Applications for these holographically produced reflection filters include head-up displays, laser protection eyewear and holographic laser beam combiners. (6 refs.)

118102 Dynamic phase hologram for laser beam steering. G.Roosen, M.-T.Plantegenest (Inst. d'Optique, Orsay, France).
J. Opt. (France), vol.14, no.4, p.199-203 (July-Aug. 1983). In French.
When interacting with a dynamic hologram, a light beam experiences changes in its diffraction direction and thus deflection. The hologram is recorded in a photorefractive material as a refractive index modulation induced by the interference of two light beams (control beam). The authors' method uses the variation of the induced grating parameters to monitor the deflection process. It is achieved in real time by simply shifting the wavelength of the control beam. Very large deflection angles are obtained while simultaneously maintaining the Bragg condition almost satisfied. Consequently good diffraction efficiency is ensured over the whole deflection process. Therefore this method has the potential to produce several thousand beam positions with a theoretical efficiency approaching 100%. Cascading two unidimensional cells the feasibility of a 2-D switch is demonstrated. (7 refs.)

118103 Photochemical time-domain holography of weak picosecond pulses. A.Rebane, R.Kaarli, P.Saari, A.Anijalg, K.Timpmann (Inst. of Phys., Acad. of Sci., Tartu, Estonian SSR).
Opt. Commun. (Netherlands), vol.47, no.3, p.173-6 (1 Sept. 1983).
The authors show that weak picosecond optical propagation through an absorbing medium with a photochemically burned-in persistent spectral hologram of a picosecond pulse train makes the sample emit coherently a replica of the pulse train applied in the burning-in cycle. (16 refs.)

118104 Construction of a two-dimensional colour hologram using a source encoding technique. F.T.S.Yu, G.Gheen, N.Wang (Electrical Engng. Dept., Pennsylvania State Univ., University Park, PA, USA).
Opt. & Laser Technol. (GB), vol.15, no.5, p.257-8 (Oct. 1983).
An adaptation of the source-encoded image subtraction system is used to form an in-plane holographic image of a colour transparency. The colour image can be retrieved by simple spatial filtering with a white-light optical processor. (7 refs.)

SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82 .... See Entry 116913

Demonstration of holograms .... See Entry 116940

Direct microscopic and microholographic observations of the solidification of particles from rapidly stirred melts .... See Entry 117226

Character recognition: a new multiple filter .... See Entry 118092

Opto-optical light deflection .... See Entry 118197

Diffracting optics .... See Entry 118253

CGH filters for coding and decoding dilute objects .... See Entry 118256

Monochromator with a plane focusing diffraction grating ..... See Entry 118260

Multiwavelength operation of an acoustooptic deflector .... See Entry 118261

An application of holographic interferometry to acoustical holography .... See Entry 118330

Holographic interferometry in vibration measurements .... See Entry 118541

Principles and applications of electron holography .... See Entry 118829

Double pulsed holographic interferometry on human beings in vivo .... See Entry 120978

42.50 QUANTUM OPTICS

118105 Transient effects, transverse mode coupling, and diffraction in swept-gain superradiance in the nonlinear regime: evolution from the superradiant state. C.M.Bowden (Res. Directorate, US Army Missile Lab., Redstone Arsenal, AL, USA), F.P.Mattar.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.151-63 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Results of numerical calculations are presented and analyzed for pulse generation and propagation in one- and two-spacial dimensions in a medium consisting of a collection of two-level atoms which are resonantly swept-excited by an impulse excitation traveling at the speed of light in the medium. The conditions imposed for the calculation in one-special dimension are that $T_1=T_2$, where T_1 and T_2 are the single atom relaxation and dephasing times, respectively, and that the gain, g, to loss, κ, ratio $g/\kappa \gg l$, which determines the nonlinear regime for pulse evolution. In addition, the authors impose that $T_2 \gg \tau_c$, where τ_c is the characteristic superradiance cooperation time, so that the pulse evolves from conditions appropriate for superradiant pulse generation for sufficiently small values for the propagation distance z. Calculational results are reported and analyzed for the transient regime of pulse buildup through the asymptotic regime of large propagation distance z where the pulse generated exhibits steady-state behavior with regard to pulse area, energy and intensity profile. Additional results of computations are presented which incorporate transverse effects and diffraction using a Gaussian radial gain profile for the initial condition. (27 refs.)

118106 Nanosecond pulse generators for testing performance of high-speed photon counting system. T.Iwata, T.Uchida, S.Minami (Dept. of Appl. Phys., Faculty of Engng., Osaka Univ., Suita, Osaka, Japan).
J. Spectrosc. Soc. Jpn. (Japan), vol.32, no.4, p.249-54 (1983). In Japanese.
High-speed pulse generators have been designed for use to evaluate the operation and performance of the time analysers in lifetime measurement systems using the photon counting technique. One of the generators provides a pair of pulses whose separation is continuously adjustable from 0 to 230 nsec. This can be used to examine the gain and pulse pair resolution of amplifier/discriminator pairs or the differential linearity of the channel width of time analysers. The other provides pulses, the rate of which exponentially decreases with time. The decay constant is stepwisely adjustable from 20 to 100 ns. With this generator, the accurate calibration of the lifetime measurement

system can be easily performed. The width and amplitude of output pulses from both generators are approximately 2 ns and 1 V, respectively. (4 refs.)

118107 Modification of the Rabi flopping frequency in the presence of a static electric field. G.F.Thomas (Massey Coll., Univ. of Toronto, Toronto, Ontario, Canada).
Opt. Commun. (Netherlands), vol.47, no.3, p.196-8 (1 Sept. 1983).
For a two-level system the net probability for stimulated one-photon emission in the presence of a static electric field is calculated within the rotating-wave aproximation and under the assumption that the static field strength (E^S) is considerably less than the oscillating field strength (E^O). Besides contributing to the power broadening of the emission signal and the Rabi flopping frequency, the static field shifts the resonance towards the blue in the amount $2E^S/E^O$. (8 refs.)

118108 Observation of self-induced Rabi oscillations in two-level atoms excited inside a resonant cavity: the ringing regime of superradiance. Y.Kaluzny, P.Goy, M.Gross, J.M.Rainmond, S.Haroche (Lab. de Phys., Ecole Normale Superieure, Paris, France).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1175-8 (26 Sept. 1983).
A collection of N Rydberg atoms and a resonant millimeter-wave cavity are shown to exchange energy back and forth at a rate $2(d/\hbar)\mathcal{E}_0\sqrt{N}$, where d is the electric dipole matrix element of the atomic transition and $\mathcal{E}_0$ the 'field per photon' in the cavity. This experiment is a demonstration of self-induced Rabi oscillations in a two-level atom system coupled to a single electromagnetic field mode and can also be considered as a very simple illustration of 'ringings' in superradiant emission. (9 refs.)

Stochastic theory of emission spectrum from strongly driven system .... See Entry 118229

42.52 MASERS

118109 Experimental study of electrodynamic system in semiconductor maser at cyclotron resonance. A.A.Vertii, I.V.Ivanchenko, S.V.Koshevaya, O.D.Pustyl'nik, V.P.Shestopalov (Inst. of Radiophys. & Electronics, Acad. of Sci., Ukrainian SSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.601-5 (July 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.827-32 (July 1982). [received: Sept. 1983]
An experimental study was made of a quasioptical two-mirror resonator, the tank circuit of a semiconductor-type cyclotron-resonance maser, at the 75.4 GHz frequency. The spectral characteristics of the resonance system were determined for various orientations of the slit, with active semiconductor material on the plane mirror relative to the electric vector of the excitation field. An open resonator with an astigmatic mirror is proposed and examined. The results of measurements on a quasioptical resonance-type polarimeter reveal that the intrinsic electromagnetic field in the resonance cell of the oscillator device is elliptically polarized. (11 refs.)

42.55 LASING PROCESSES

Modification of the Rabi flopping frequency in the presence of a static electric field .... See Entry 118107

Observation of self-induced Rabi oscillations in two-level atoms excited inside a resonant cavity: the ringing regime of superradiance .... See Entry 118108

Conversion of pump radiation in luminescent substances .... See Entry 118203

Investigation of jet flow past slotted and wedge-shaped nozzles in a shock tube [of relevance to gasdynamic lasers] .... See Entry 118654

42.55B General theory of lasing action

118110 Exponent behaviors of single mode laser system with saturable absorber near threshold. Liu Jian-min (Dept. of Phys., Nanjing Univ., Nanjing, China).
Commun. Theor. Phys. (China), vol.2, no.3, p.1153-6 (1983).
The author discusses the exponential behaviors near the threshold of a single mode laser system in the presence of a saturable absorber. Four threshold exponents and four threshold amplitudes are obtained. They obey the generalized scaling laws of $z=4$. (12 refs.)

118111 Classical derivation of the laser rate equation. D.Marcuse (Crawford Hill Labs., Bell Labs., Holmdel, NJ, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1228-31 (Aug. 1983).
The author derives the rate equation for the energy (photon) density inside the resonant cavity of a laser oscillator from Maxwell's equations. By comparison to the familiar photon rate equation, this classical derivation can be used to obtain the well-known expression for the ratio of the power that is spontaneously emitted into a single laser mode relative to the total amount of spontaneous emission. This independent derivation does not require mode counting procedures and settles the following question: what fraction of the total power that is spontaneously emitted into the wavelength range of the fluorescent linewidth is utilized for increasing the energy in a given laser mode?. (6 refs.)

118112 Radiation amplification without population inversion at transitions to autoionizing states. V.G.Arkhipkin, Yu.I.Heller (L.V. Kirensky Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.12-14 (3 Oct. 1983).
The spectrum dependence of an autoionizing resonance in photoabsorption on the autoionizing state population is studied. The possibility arises of obtaining amplified radiation in the region of the photoabsorption minimum without population inversion. The possibility of amplifying the radiation in the region of laser-induced autoionizing-like resonances in the continuum is also discussed. (9 refs.)

118113 On the use of piecewise exponential functions in transfer theory. A.V.Kondrashenko.
Zh. Vychisl. Mat. & Mat. Fiz. (USSR), vol.23, no.4, p.965-72 (July-Aug. 1983). In Russian. English translation in: *USSR Comput. Math. & Math. Phys. (GB)*
A method is proposed for the numerical integration of one-dimensional equations of radiative transfer in a laser, based on a search of their approximation solutions in the form of continuous piecewise exponential functions. From the results of calculations of a two-level model of a laser by the proposed method the practical possibility of a numerical investigation of the energy characteristics of some types of laser is shown (in particular, those in which pumping does not depend on spatial displacement and is a function only of time), using a small number of spatial points. (8 refs.) *A.G.C.*

Theory of spontaneous emission in gain-guided laser amplifiers .... See Entry 118140

42.55D CO_2 lasers

118114 Pulse-broadening mechanism in injection mode-locked TEA CO_2 lasers. F.A.van Goor (Dept. of Appl. Phys., Twente Univ. of Technol., Enschede, Netherlands).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.335-7 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
To study the pulse-broadening mechanism in an injection mode-locked TEA CO_2 laser oscillator, a train of Gaussian pulses with variable widths were injected in the slave-oscillator. Theoretical analyses and experimental data are presented of the AM mode-locked master-oscillator with an additional c.w. low-pressure gain cell in the cavity and of the broadening mechanism on the injected pulse in the slave-oscillator. (6 refs.)

118115 Thermal defocusing (LIMP) in stable CO_2 resonators. E.K.Gorton, E.W.Parcell (Royal Signals & Radar Establ., Great Malvern, England).
J. Phys. D (GB), vol.16, no.10, p.1827-35 (14 Oct. 1983).
The effect on the output of an electron beam sustained CO_2 laser due to LIMP (laser induced medium perturbation) is examined. An approximate theory is developed which leads to basic agreement with the experimental observations of beam spreading and temporal pulse structure. (10 refs.)

118116 Experimental check on a theoretical model for a CO_2 GDL based on combustion products at high stagnation temperatures. N.V.Evtyukhin, S.V.Kulikov, M.E.Solov'eva.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.733-7 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR)*, vol.23, no.6, p.4-9 (Nov.-Dec. 1982). [received: Sept. 1983]
The authors have measured and calculated rate constants for vibrational energy transfer for stagnation temperatures up to 2400K for a series of multicomponent media covering almost all the limiting cases of working media for CO_2 gasdynamic lasers based on combustion products. The flow through a profiled nozzle with a fairly large degree of expansion was also examined. (24 refs.)

Laser 83 Opto-Elektronik. 6th International Congress and International Trade Fair (papers in summary form only received) .... See Entry 116929

Effects of quantum flux on the relaxation of paired modes of the CO_2 molecule .... See Entry 117972

High-power, subpicosecond 10-μm pulse generation .... See Entry 118157

Atmospheric-pressure electroionization CO_2 laser using CO_2:N_2:H_2O mixtures .... See Entry 118166

Amplitude modulation of the radiation of a CO_2-laser by optically controlled absorption in semiconductors .... See Entry 118176

Spectrophone stabilization and offset tuning of a carbon dioxide waveguide laser .... See Entry 118187

Optical materials for CO_2 lasers .... See Entry 118236

42.55F Inert gas lasers

118117 Investigation of the characteristics of an XeCl* discharge laser with ionization by a low-density electron beam. N.G.Basov, V.A.Danilychev, O.M.Kerimov, A.I.Milanich, T.S.Khachapuridze (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.391-3 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.643-6 (March 1983). [received: Oct. 1983]
An investigation was made of the energy, spectral, and time characteristics of an XeCl* discharge laser stabilized by an electron beam. The electron-beam current density could be reduced to 0.1 mA/cm^2. The maximum output energy of ~10 J/liter was obtained for a mixture of the HCl:Xe:Ne=1:10:500 composition at $p=4$ atm. The absorption in the region of 500 nm within the emission band of Xe_2Cl was due to the absorption by Xe in lower metastable states. (6 refs.)

118118 XeF* visible laser with selective optical excitation. V.M.Buchnev, A.D.Klementov, V.M.Nesterov, S.A.Pendyur, P.B.Sergeev, B.N.Toleutaev, S.V.Shul'ga (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.394-5 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.647-9 (March 1983). [received: Oct. 1983]
The coefficient representing utilization of the electron beam energy ($K\sim2.3\times10^{-3}$) in dissociation of XeF_2 vapor was determined. This dissociation occurred under the action of selective radiation emitted from electron-beam-excited Xe_2* dimers. Lasing was observed as a result of the *C-A* transition in the XeF* molecule ($\lambda=480$ nm) and the output energy was 3.1 mJ. (10 refs.)

CW Ar^+ laser pumped by an intense electron beam .... See Entry 118159

42.55H Lasing action in other gas lasers

118119 Radiation characteristics of XeCl*, XeF* and XeBr* molecular lasers with beam and discharge excitation. Yu.I.Bychkov, G.A.Mesyats, V.F.Tarasenko (Inst. of Heavy Current Electronics, Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.12-16 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1566-71 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
The results of tests on XeF-($\lambda=351$ nm), XeCl-($\lambda=308$ nm), and XeBr-($\lambda=282$ nm) lasers with two types of excitation—electron beam and electron-beam-sustained discharge—are reported. The experiments were performed with an electron beam of comparatively short duration, ~50 nsec. The short excitation time is of interest in that it makes it possible to produce powerful pulses of radiation lasting ~20-30 nsec; in addition, it is easy to obtain high beam-current densities with a short electron-beam pulse and, consequently, the limiting characteristics of the lasers with very powerful pumping can be studied with beam excitation. When the laser is excited by an electron-beam-sustained discharge, the short excitation time results in a high ratio of discharge energy to beam energy. Thus, these considerations point up the importance of investigating the characteristics of excimer lasers excited with short-duration electron beams. (14 refs.)

118120 CW far-infrared lasing in $^{15}NH_3$, Stark resonantly pumped by a CO_2 or N_2O laser. C.Gastaud, P.Belland, M.Redon, M.Fourrier (Lab. de Dispositifs Infra-Rouge, Univ. Pierre et Marie Curie, Paris, France).
Appl. Phys. B (Germany), vol.B32, no.2, p.79-81 (Oct. 1983).
48 new resonant pumping schemes, by IR Stark tuning, have been performed on $^{15}NH_3$, with CW CO_2 and N_2O lasers. Among the 25 different FIR

wavelengths obtained, 15 correspond to new emissions, raising thus to 45 the total number of CW FIR emissions from this gas, in the presence of electric field. (6 refs.)

118121 Population inversion in thallium by flashlamp-photodissociation of TlI. G.Rinke (Lehrstuhl fur Lichttech. und Phys. Elektronik, Univ. Karlsruhe, Karlsruhe, Germany).
Appl. Phys. B (Germany), vol.B32, no.2, p.83-4 (Oct. 1983).
A population inversion between the 6 $^2P_{3/2}$ and 6 $^2P_{1/2}$ state of thallium has been achieved for the first time by incoherent photodissociation of TlI. This is accomplished by using wall-ablating flashlamps of short risetime and appropriate light filtering. The inversion lasts about 4 μs and is terminated by quenching collisions. (10 refs.)

118122 Operation and performance of the CW visible atomic mercury laser. M.D.Rabbett, S.M.Skippon, T.A.King (Phys. Dept., Univ. of Manchester, Manchester, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.328-34 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The operating characteristics of CW atomic mercury lasers are described. Operating at 546.1 nm the laser is optically pumped by DC mercury discharge lamps. The laser has high perceptual brightness and potentially low noise and high stability. Experimental and theoretical aspects of the laser and its performance are discussed and the effectiveness of various optical coupling schemes considered. Evidence for absorption loss due to mercury dimers is presented and some results are given for direct measurement of this loss by tunable dye laser. (10 refs.)

118123 Millimeter wave spectroscopic studies of collision-induced energy transfer processes in the $^{13}CH_3F$ laser. W.H.Matteson, F.De Lucia (Dept. of Phys., Duke Univ., Durham, NC, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1284-83 (Aug. 1983).
Millimeter wave spectroscopic techniques have been used to study the collision induced energy transfer processes that are important for the understanding of the 1.2 mm $^{13}CH_3F$ optically pumped FIR laser. In these experiments the microwave diagnostic probe is copropagated with the CO_2 laser pump beam through a gain cell. The continuous tunability and absolute frequency reference of the experimental technique have made possible a quantitative investigation of the emission/absorption profiles of approximately 25 rotational transitions. From these experimental results and a simple but accurate theoretical model, energy transfer parameters have been calculated by means of a nonlinear least squares fit. These parameters accurately account for all observations and are readily interpretable on the basis of the authors' understanding of fundamental collisional and radiative processes. (31 refs.)

118124 Penning collisions in hollow cathode He-Cd$^+$ lasers. M.D.Ainsworth, A.I.McIntosh (Dept. of Phys., Univ. of New England, Armidale, NSW, Australia).
J. Phys. D (GB), vol.16, no.10, p.L189-92 (14 Oct. 1983).
Recent publications have shown that electron impact collisions are more important than Penning collisions in populating the upper level of the 441.6 nm transition of He-Cd$^+$ lasers operated as positive column discharges. The authors present evidence that this is not the case in hollow cathode discharges. (10 refs.)

118125 Gain measurements and high resolution spectroscopy of the 546.1 nm atomic mercury laser transition. S.M.Skippon, T.A.King, M.D.Rabbett (Phys. Dept., Manchester Univ., Manchester, England).
J. Phys. D (GB), vol.16, no.10, p.1837-42 (14 Oct. 1983).
An investigation of the gain of a CW atomic mercury laser using a tunable dye laser is reported. Several isotopes are seen to be simultaneously excited and found to lase in multiple isotope mixtures. The nitrogen pressure dependence of the gain is found to be in good agreement with rate equation analyses, provided a pressure dependent loss term due to mercury dimers is taken into account. The pressure broadening of the laser transition by nitrogen has been measured to be 21.1 MHz mbar^{-1}. (12 refs.)

118126 Visible iodine and bromine laser, and coaxial discharge excited strong UV iodine laser. C.C.Chou, M.C.Tsao, M.S.Chiu (Shanghai Inst. of Laser Technol., Shanghai, China), F.Y.Chiu.
Opt. Commun. (Netherlands), vol.47, no.3, p.218-22 (1 Sept. 1983).
Nine new Br and I ion laser lines in the visible and the UV regions were observed by ordinary longitudinal pulsed discharge or coaxial pulsed discharge. This is the first time that the UV I ion laser was obtained with an output much stronger than that of ordinary pulsed ion lasers. The characteristics of the laser output were investigated in the case of coaxial discharge. (14 refs.)

118127 Anti-Stokes Raman laser emission at 149 nm in atomic bromine. J.C.White, D.Henderson (Bell Labs., Holmdel, NJ, USA).
Opt. Lett. (USA), vol.8, no.10, p.520-2 (Oct. 1983).
Upconversion of an F_2 discharge laser (157 nm) to 149 nm by means of anti-Stokes Raman laser emission in inverted, metastable Br atoms is reported. Approximately 0.1 mJ of energy in a 5-nsec-duration pulse was observed, implying a peak power of 20 kW in the VUV. This represents the first reported use of Br as an anti-Stokes laser medium and the first reported application of this technique for the upconversion of excimer or discharge lasers and is the deepest VUV wavelength yet created by this general method. (10 refs.)

118128 Characteristics of the pulse-periodic regime of excimer lasers. V.Yu.Baranov, V.M.Borisov, A.Yu.Vinokhodov, F.I.Vysikailo, Yu.B.Kiryukhin (I.V. Kurchatov Inst. of Atomic Energy, Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.318-22 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.540-6 (March 1983). [received: Oct. 1983]
An investigation was made of the influence of inhomogeneity of the gas density in the pulse-periodic regime on the average power of an excimer laser. The experimental results agreed qualitatively with the proposed model. An average power of ~130 W was obtained from a pulse-periodic XeCl excimer laser at a repetition frequency of ~500 Hz. (11 refs.)

118129 Investigation of lasing in active media utilizing transitions in manganese atoms. V.K.Isakov, S.E.Potapov.
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.348-54 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.588-97 (March 1983). [received: Oct. 1983]
A study was made of the energy characteristics and spectral composition of the radiation emitted by self-heating manganese vapor lasers as a function of their active-medium parameters and excitation conditions in discharge tubes of various diameters. The dependences obtained were used as a basis for discussing the lasing mechanism. The relationship was considered between the elementary processes occurring in the pulsed plasma discharge and the parameters of the emitted radiation. A total laser output power of 12 W, at an efficiency of 0.3%, was obtained in a 2-cm diameter tube of 200 cm^3 volume. (20 refs.)

118130 Optimization of metal vapor lasers. V.V.Buchanov, E.I.Molodykh, V.V.Tykotskii.
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.378-80 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.629-31 (March 1983). [received: Oct. 1983]
A method is proposed for the optimization of metal vapor lasers on the basis of a universal numerical calculation program and simultaneous application of an algorithm for multifactor optimization of the output parameters based on the complex Boks method and the Gel'fand-Tsetlin ravine function method. The results are given of a three-parameter optimization of a transverse-discharge copper vapor laser. (9 refs.)

118131 Lasing of CF_3I molecules in the 1-mm range. V.A.Bugaev, E.P.Shliteris (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.404-6 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.658-61 (March 1983). [received: Oct. 1983]
Eight laser transitions were observed in the range 0.8-1.25 mm when CF_3I vapor was pumped by radiation from a low-pressure CO_2 laser. The observed infrared and millimeter transitions were identified. (10 refs.)

118132 A submillimeter ammonia and its deuteron-substitute optically pumped continuous laser. V.G.Gerasimov, S.F.Dyubko, M.N.Efimenko, L.D.Fesenko, V.I.Yartsev.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1323-7 (Sept. 1983). In Russian.
Thirty-three new generation lines for a continuous submillimeter laser with optical pumping on deuterosubstitute NH_3 molecules have been obtained for the first time. Part of the results is obtained owing to the Stark effect application for tuning frequencies of the absorbing transitions of the active medium in resonance with the CO_2-laser pumping radiation. (9 refs.)

The effect of added nitrogen on multiphoton absorption by ammonia ....See Entry 117945

Characteristics of some gas discharge lasers .... See Entry 118167

Two-dimensional simulation of a plasma KrF pulse compressor ....See Entry 118174

A new approach to the generation of high-power nanosecond pulses in CO_2 lasers ....See Entry 118180

Spectral quality of He-Zn II and He-Cd II hollow cathode metal vapor lasers in the magnetic fields ....See Entry 118188

Continuous tuning of the frequency of an NH_3 laser within the gain profile ....See Entry 118191

Synthesis of the D_2O laser frequency ($\lambda = 84$ μ) using a superconducting nonlinear device ....See Entry 118220

Gain in the 100-1000 Å range in a homogeneous stationary plasma ....See Entry 118713

Particle densities in high current hollow cathode discharges ..See Entry 118786

42.55K Chemical lasers

(see also 82.40T Chemiluminescence and chemical laser kinetics)

118133 Computation of reacting flowfield with radiation interaction in chemical lasers. V.Quan, S.F.Persselin, T.T.Yang (Rockwell Internat./Rocketdyne Div., Canoga Park, CA, USA).
AIAA J. (USA), vol.21, no.9, p.1283-8 (Sept. 1983).
A numerical procedure has been developed to provide a rapid and stable solution of the reacting and radiating flowfield in chemical laser cavities. A marching technique, implicit in both fluid mechanics and chemistry, is employed in solving the two-dimensional mixing layer equations. The aerokinetics and radiation interaction is calculated iteratively by solving the aerokinetic equations for the gain distribution and the propagation equations for the radiation field. In the iterative solution, a linearization method which leads to enhanced numerical efficiency is employed. (12 refs.)

118134 Chemical lasers: new results and ideas. A.N.Oraevskii (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.1-11 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1554-65 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
The most significant advances of recent years in the field of pulsed and continuous chemical lasers are reviewed. New ideas that may indicate the future pathways of chemical-laser development are analyzed. (47 refs.)

42.55M Lasing action in liquids and organic dyes

118135 Picosecond dye laser emission in the infrared between 1.4 and 1.8 μm. H.J.Polland, T.Elsaesser, A.Seilmeier, W.Kaiser (Dept. of Phys., Tech. Univ., Munchen, Germany), M.Kussler, N.J.Marx, B.Sens, K.H.Drexhage.
Appl. Phys. B (Germany), vol.B32, no.2, p.53-7 (Oct. 1983).
The stimulated emission of new infrared dyes was investigated. The dyes have short S_1-lifetimes between 5 and 12 ps with corresponding low fluorescence quantum efficiencies of 10^{-3} to 10^{-4}. In spite of this, 2% of the pumping energy was converted to an intense infrared pulse with frequencies between 5550 cm^{-1} (1.8 μm) and 7150 cm^{-1} (1.4 μm). The dye solutions were excited by single picosecond pulses of a Nd:glass laser in a travelling wave system consisting of a diffraction grating and a transversely pumped dye cell. The pulse duration at 6250 cm^{-1} was measured to be 6 ps. (11 refs.)

118136 Evanescent amplification in a single-mode optical fibre. W.V.Sorin, K.P.Jackson, H.J.Shaw (Edward L. Ginzton Lab., Stanford Univ., Stanford, CA, USA).
Electron. Lett. (GB), vol.19, no.20, p.820-2 (29 Sept. 1983).
By replacing a portion of the cladding of a single-mode fibre with a laser dye, amplification can be achieved by means of an evanescent field interaction. External gains as high as 22 dB have been measured by guiding both a pulsed pump and CW signal within the single-mode fibre. (5 refs.)

118137 Use of photoprotolytic reaction for extending the tuning range of the emission wavelength of a 3-methoxybenzanthrone laser. L.D.Derkacheva, A.I.Krymova, V.A.Petukhov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.384-6 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.636-8 (March 1983). [received: Oct. 1983]
An investigation was made of the luminescence and lasing characteristics of 3-methoxybenzanthrone solutions of different acidity. It was established that at a certain acidity of a solution the transfer of molecules of this dye to an excited state produced a new ionic form resulting from the attachment of a hydrogen ion. When a solution with the optimal acidity was pumped with the

second harmonic of a ruby laser, stimulated emission was observed for both ionic forms and continuous wavelength tuning was attained in the range 540-660 nm. (11 refs.)

Narrow output line from a distributed-feedback dye laser with broad-spectrum pumping .... See Entry 118165

Characteristics of some gas discharge lasers .... See Entry 118167

Observation of intensity fluctuations and mode correlations in a broadband CW dye laser .... See Entry 118189

42.55P Lasing action in semiconductors with junctions

118138 Optically pumped laser operation of InGaAsP/InGaP double heterostructures grown by metalorganic chemical vapor deposition. T.Iwamoto, K.Mori, M.Mizuta, H.Kukimoto (Imaging Sci. & Engng. Lab., Tokyo Inst. of Technol., Yokohama, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L429-31 (July 1983).
InGaAsP/InGaP double heterostructures have been grown on GaAs(100) substrates by low pressure metalorganic chemical vapor deposition. The authors have carried out a lasing experiment with a cleaved sample of $\sim$200 μm width by optical pumping. At high excitation levels, they have observed a stimulated emission of a wavelength of 717 nm at 150 k. The threshold power density is estimated to be about 4.5×10^4 W/cm^2 at this temperature. They also mention the room-temperature lasing operation of similar double heterostructure samples. (10 refs.)

118139 Life test of 30 mW GaAlAs TAL laser grown by OMVPE. J.Vilms, R.W.H.Engelmann (Hewlett-Packard Labs., Palo Alto, CA, USA).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L455-7 (July 1983).
Operating life data taken at 70 and 80°C at an output power level of 30 mW CW from one facet are presented for a protonisolated stripe, (Ga, Al)As Thin Active Layer DH laser grown by Organo-Metallic Vapor Phase Exitaxy, and mounted epi-side up on a Si submount with Sn solder. Median life of 450 h at 80°C ambient and 2500 h at 70°C ambient was observed. The failure mode is gradual increase of threshold current combined with decrease of the kink power level below the operating point. (10 refs.)

118140 Theory of spontaneous emission in gain-guided laser amplifiers. J.Arnaud (Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Electron. Lett. (GB), vol.19, no.19, p.798-800 (15 Sept. 1983).
The author gives an argument suggesting that spontaneous emission in gain-guided laser amplifiers is enhanced by a factor much smaller than the *K*-factor previously calculated. This is because the fundamental mode content of the spontaneous emission field should be calculated in the sense of the Hermitian rather than direct product at the laser output. (4 refs.)

118141 Gain measurements on semiconductor lasers by optical feedback from an external grating cavity. N.Gade, J.H.Osmundsen (Electromagnetic Inst., Tech. Univ. of Denmark, Lyngby, Denmark).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1238-42 (Aug. 1983).
The authors report on new methods to determine the curvature around maximum of the mode gain curve of homogeneously line-broadened semiconductor lasers, either by measuring the wavelength dependence of threshold current of the laser coupled to an external grating cavity or by measuring the tuning range of the laser versus the amount of optical feedback. The authors experimentally found the mode gain width and the current-induced peak-gain wavelength shift of a GaAlAs CSP laser to 175 Å and 2.1 Å/mA, respectively. (19 refs.)

118142 Gain and carrier lifetime measurements in AlGaAs single quantum well lasers. N.K.Dutta, R.L.Hartman, W.T.Tsang (Bell Labs., Murray Hill, NJ, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1243-6 (Aug. 1983).
The authors have measured the optical gain and carrier lifetime (τ) at threshold in AlGaAs single quantum well lasers in the temperature range 10-70°C. The small shift of the spectral position of the gain peak with increasing injection is evidence for the two-dimensional-like density of states in a quantum well. The net gain G is found to vary linearly with the current I. The observed slow decrease of dG/dI and τ with increasing temperature suggests the absence of a large temperature-dependent nonradiative carrier loss or optical absorption loss in these lasers. This is also supported by the observed low temperature dependence of the external differential quantum efficiency. (12 refs.)

118143 Two-dimensional quantum-mechanical confinement of electrons in DH lasers by strong magnetic fields. Y.Arakawa, H.Sakaki, M.Nishioka (Inst. of Industrial Sci., Univ. of Tokyo, Tokyo, Japan), N.Miura.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1255-7 (Aug. 1983).
Two-dimensional quantum-mechanical confinement of electrons in DH lasers is realized near room temperature by applying strong magnetic fields up to 32 T. In order to confirm the realization of two-dimensional quantum-mechanical confinement of electrons in such lasers, the spectral characteristics are measured. The observed shift of the lasing wavelength with magnetic fields is shown to correspond to the upward shift of the lowest Landau level with the increase of magnetic fields. (11 refs.)

118144 A study of optical amplification in a double heterostructure GaAs device using the density matrix approach. M.T.Tavis (Electronics Res. Lab., Aerospace Corp., El Segundo, CA, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1302-11 (Aug. 1983).
A theoretical investigation of traveling wave light amplification in a GaAs double heterostructure device is presented. The analysis is self-consistent, semiclassical, and uses a density matrix formulation. Phenomenological constants are included to account for intraband relaxation processes, pumping, and spontaneous emission. The analysis is significantly different from previous rate equation approaches in that saturation effects are inherent in the results and phase information, important for coherent applications, is retained. Results presented for steady-state and pulsed operation include gain, pulse compression, multipulse effects, and the phase variation that occurs over the pulse time. (33 refs.)

118145 Temperature characteristics of double-carrier-confinement (DCC) heterojunction InGaAsP(λ=1.3 μm)/InP lasers. M.Yano, Y.Nishitani, K.Hori, M.Takusagawa (Fujitsu Labs. Ltd., Kawasaki, Japan).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1319-27 (Aug. 1983).
Reports on a detailed study of the oscillation characteristics of double-carrier-confinement (DCC) heterojunction InGaAsP(λ=1.3 μm)/InP lasers, with special emphasis on their temperature characteristics. In addition to conventional double-heterojunction lasers, these lasers have a p-InGaAsP second active layer sandwiched between the p-InP clad layers. The spectral characteristics below threshold were examined in order to verify electron leakage beyond the heterobarrier of the p-InP thin clad layer, and to study the contribution of the second active layer to optical gain and laser action. Threshold temperature characteristics were also investigated through an analysis of the heterojunction energy band structure. The results indicate that emission from the second active layer is caused by electron leakage. In order to obtain high temperature stability for these lasers, it is essential that both the first and second active layers contribute to the optical gain spectrum and laser action. (23 refs.)

118146 Determination of p-n junctions in InP/GaInAsP laser heterostructures using a profilometer. J.Walachova, D.Nohavica (Inst. of Radio Engng. & Electronics, Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K69-72 (Sept. 1983).
The knowledge of the correct position of the p-n junction in InP/GaInAsP laser heterostructures is very important for the fabrication of good lasers emitting near 1.3 μm. The method presented utilizes measurements of the doping and/or the composition profile of the heterostructure. When profiling a lightly-loaded metal probe is tracked slowly down the bevelled heterostructure. A fixed bias is applied between the probe and the bevelled heterostructure and the current through the probe is measured. This current is displayed on a chart recorder. The profiles have been measured only for one polarity (negative) of the probe. The authors find that the profiling for both polarities of the probe is very useful and by comparing these two profiles one can find the position of the p-n junction in the heterostructure. (4 refs.)

118147 Spectral gain profile of a GaAlAs injection heterolaser. I.S.Goldobin, L.A.Rivlin, A.T.Semenov, A.F.Solodkov, V.P.Tabunov, Yu.A.Tambiev, S.D.Yakubovich (All-Union Sci.-Res. Inst. of Optophys. Measurements, Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.354-7 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.598-602 (March 1983). [received: Oct. 1983]
An experimental investigation was made of the gain profile of an injection heterolaser and a satisfactory generalization of this profile was obtained in the form of expressions analogous to those that follow from the usual model of heavily doped gallium arsenide in which transitions take place between the density-of-states tail at the bottom of the conduction band and a local level, violating the selection rules on the quasimomentum. (13 refs.)

118148 Experimental investigation of inhomogeneously pumped injection lasers. V.I.Borodulin, V.P.Konyaev, E.R.Novikova, A.A.Tager, D.P.Tregub, B.B.Elenkrig (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.398-401 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.652-5 (March 1983). [received: Oct. 1983]
An investigation was made of inhomogeneously pumped injection lasers in the form of $Al_xGa_{1-x}As$-GaAs double heterostructures. Bistable operation of such lasers was demonstrated and the switching time between the two states was less than 2×10^{-10} sec. A study was made of regular pulsations of the output radiation resulting from inhomogeneous pumping. The pulsation frequency was tunable up to 2 GHz and the duration of each pulsation (spike) was less than 2.5×10^{-1} sec. It was found that the pulsation frequency obeyed $f\propto(I-I_{th})^{1/2}$, where I and I_{th} are the current through the heterodiode and the threshold value of this current, respectively. (7 refs.)

VPE-grown 1.3 μm InGaAsP/InP double-channel planar buried-heterostructure laser diode with LPE-burying layers .... See Entry 118160

Selective meltbacked substrate inner-stripe AlGaAs/GaAs lasers operated under room temperature CW condition .... See Entry 118161

High-speed 1.55 μm single-longitudinal-mode ridge waveguide C^3 laser .... See Entry 118162

Reliability of InGaAsP/InP buried heterostructure 1.3 μm lasers .... See Entry 118163

Low-threshold InGaAsP ridge waveguide lasers at 1.3 μm .... See Entry 118164

Ultrashort optical pulse generation from microwave modulated AlGaAs diode laser with Selfoc rod resonator .... See Entry 118178

Measurement of spectra of and correlation between FM and AM noises in GaAlAs lasers .... See Entry 118186

Optical properties for an antireflection-coated LD optical switch .... See Entry 118194

42.55R Lasing action in other solids

(inc. solid Raman lasers)

118149 Materials for quantum electronics (yttrium-aluminum garnet, lithium niobate). G.M.Zverev (Moscow Physicotech. Inst., Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.49-54 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1614-21 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
The properties of yttrium-aluminum garnet (YAG) crystals that determine the parameters of lasers using YAG crystals doped with neodymium ions are considered in various operating regimes, along with certain properties of lithium niobate crystals that are significant in such lasers. Broad prospects for the use of YAG lasers are indicated and the parameters of certain series-produced lasers of this type are cited. (16 refs.)

118150 Amplified spontaneous emission in doped alkali-halides. G.P.Pazzi, M.G.Baldecchi, P.Fabeni, R.Linari, A.Ranfagni, A.Agresti (Istituto di Ricerca sulle Onde Elettromagnetiche, CNR, Firenze, Italy), M.Cetica, D.J.Simkin.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.338-44 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Considers the possibility of obtaining optical amplification in the UV/visible region by means of doped alkali-halide crystals, pumped by a nitrogen laser. The amplified spontaneous emission (ASE) technique is adopted with continuous recording of the luminescence intensity as a function of either the pump intensity or the pumped length. In the latter case the pumping beam inhomogeneity is taken into account. A CsI crystal doped with In^+ and Tl^+ was investigated at room temperature. The fast component of the emission ($\sim$10 ns) at 430 nm showed a gain of about 1.5 with a pumping of 10^4 W/cm on a length of 8 mm. There is experimental evidence that the active element is thallium after investigation on $CsI:Tl^+$ and $CsI:In^+$ crystals. Negative results of amplification for $KI:Tl^+$ and $KI:Ag^+$ were obtained. (9 refs.)

118151 Low-threshold semiconductor Raman laser. K.Suto, J.Nishizawa (Res. Inst. of Electrical Communication, Tohoku Univ., Sendai, Japan).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1251-4 (Aug. 1983).
A semiconductor Raman laser using the longitudinal optical (LO) phonon mode of GaP has a very low threshold compared to the transverse optical (TO) phonon mode of GaP and even compared to simulated Raman scatterings in various kinds of liquids and insulating solid materials. The lowest threshold value of the pulsed input optical power is 8 kW (5×10^6 W/cm^2) at room temperature. Far infrared radiation (24.8 μm) has been generated by

placing both GaP with the LO phonon mode and GaAs with the TO phonon mode in a Fabry-Perot resonator. The maximum far infrared power has been 3 W. (7 refs.)

118152 Pulsed YAG:Nd^{3+} laser with a passive Q switch in the form of an LiF crystal containing F_2^- centers. T.T.Basiev, I.Ya.Itskhoki, B.G.Lysoi, S.B.Mirov, O.B.Cherednichenko.
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.370-2 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.619-21 (March 1983). [received: Oct. 1983]
An investigation was made of the energy characteristics of a YAG:Nd^{3+} laser subjected to pulse-periodic pumping and to passive Q switching of a resonator by an LiF crystal containing F_2^- color centers. A comparison was made of the energy of giant laser pulses obtained using passive and electrooptic switches when the pump pulse repetition frequency was up to 50 Hz. The use of a passive switch made of an LiF:F_2^- crystal under optimal lasing conditions did not reduce the energy of the output pulses of the laser compared with that attainable using an electrooptic Q switch. (9 refs.)

Pulsed-pump tunable lasers .... See Entry 118158

Actively mode-locked and Q-switched YAG laser with precise synchronizability .... See Entry 118173

Self-modulation of radiation in a single-pulse ruby laser .... See Entry 118177

Controlling the length of ultrashort light pulses from a Q-switched ruby laser .... See Entry 118179

Active media of solid-state lasers .... See Entry 118181

Image-converter recording of picosecond pulses emitted by an erbium laser (λ=2.94 μ) with active mode locking .... See Entry 118190

Ultraviolet four-photon mixing in a multimode silica fiber Raman amplifier .... See Entry 118215

Second harmonic generation in a YAG laser with self-locking of longitudinal modes .... See Entry 118219

Stimulated emissions from Er^{3+} ions at 1.7 μm in self-activated oxygen-containing Er crystals .... See Entry 120112

Fluorescence and its Nd^{3+} concentration dependence of Nd-doped SiO$_2$ glasses prepared by plasma torch CVD .... See Entry 120121

Influence of the crystal structure on the luminescence properties of rare earths .... See Entry 120134

Future technological applications of rare-earth-doped materials .... See Entry 120755

42.55T Free electron lasers

118153 Free-electron lasers: prospects for advancing classical electron generators into short-wavelength bands. V.L.Bratman, N.S.Ginzburg, M.I.Petelin (Inst. of Appl. Phys., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.33-40 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1593-602 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
Theoretical and experimental research toward the use of relativistic electron beams to produce electromagnetic waves in bands ranging from submillimeter to X-ray are reviewed. (32 refs.)

42.60 LASER SYSTEMS AND LASER BEAM APPLICATIONS

118154 Recent advances in laser technology. M.F.Stel'makh (Moscow Physicotech. Inst., Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.93-7 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1670-6 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
Describes a new generation of 'Kvant'-series technological equipment which has been designed to make extensive use of unification and consolidation principles. These developments are based on a unified series of base-system models with YAG and neodymium-glass lasers with average or continuous radiated powders from 16 to 500 W. Seven or eight types of base model using a limited range of standard laser radiators, power sources, cooling systems, and other functional subassemblies for use in development of over 20 types of special purpose systems for various applications. (12 refs.)

118155 Picosecond spectra of gain-switched quaternary lasers. M.Osinski (Dept. of Electronics, Univ. of Southampton, Southampton, England), M.J.Adams.
Opt. Commun. (Netherlands), vol.47, no.3, p.190-2 (1 Sept. 1983).
Detailed analysis of picosecond pulse generation in 1.55 μm lasers is reported. Large dynamic linewidth ($\approx$100 GHz) is predicted for lasers driven to 10 times threshold. Spectra emitted by lasers biased below and above threshold are compared, and the spectral purity of the optical pulse is shown to improve considerably when a prebias condition above threshold is chosen. (13 refs.)

118156 Generation of single longitudinal mode pulses in passively Q-switched lasers via passive pre-lasing. S.Jackel, R.Laluz, B.Arad, A.Borowitz, S.Eliezer, M.Givon, A.Ludmirsky, H.Szichmann (Dept. of Plasma Phys., Soreq Nuclear Res. Centre, Yavne, Israel).
Opt. Commun. (Netherlands), vol.47, no.3, p.205-11 (1 Sept. 1983).
Greatly improved control over the production of single longitudinal mode (SLM) laser pulses is obtained by applying pre-lase techniques to passively Q-switched oscillators. Passive but controlled pre-lasing is obtained by forming a subcavity within the main Q-switching cavity. Use of pre-lasing and a single solid low-reflectivity etalon resulted in 96% SLM production over 5 h periods during which the oscillator fired intermittently several thousand times in a non-stabilized temperature environment and without any active feedback. (14 refs.)

118157 High-power, subpicosecond 10-μm pulse generation. P.B.Corkum (Div. of Phys., Nat. Res. Council of Canada, Ottawa, Canada).
Opt. Lett. (USA), vol.8, no.10, p.514-16 (Oct. 1983).
Two-picosecond, 10-μm pulses, generated by optical semiconductor switching, have been regeneratively amplified in a multiatmosphere TE CO$_2$ gain module. Pulses have been produced with a peak circulating energy of $\sim$15 mJ and a power density in the gain medium in excess of 10^{12} W/cm^2. A plasma-breakdown wave traveling with the regeneratively amplified pulse, combined with anomalous dispersion in the NaCl windows, has permitted compression of these pulses to less than 1 psec in duration. (6 refs.)

SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82 .... See Entry 116913

Laser 83 Opto-Elektronik. 6th International Congress and International Trade Fair (papers in summary form only received) .... See Entry 116929

Materials for quantum electronics (yttrium-aluminum garnet, lithium niobate) .... See Entry 118149

Conversion of pump radiation in luminescent substances .... See Entry 118203

Characteristics of K-Rb lamps as the pump sources for YAG:Nd^{3+} lasers .... See Entry 118240

42.60B Design of specific laser systems

118158 Pulsed-pump tunable lasers. V.G.Dmitriev, O.B.Cherednichenko (Moscow Physicotech. Inst., Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.132-41 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1720-32 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
Reviews the most interesting advances in the design of lasers with frequency conversion in the nonlinear crystals and solutions of organic compounds with periodic (50-100 Hz) pulsed YAG-Nd^{3+} lasers as bases. The authors touch upon the following aspects of the subject; (i) certain peculiarities of second-harmonic generation (SHG) in periodic pulsed YAG-Nd^{3+} lasers, (ii) prospects for SHG in active-nonlinear media of the LiNbO$_3$:Nd^{3+} type, (iii) parametric light generation (PLG) in specially oriented LiNBo$_3$ crystals with direct pumping from YAG-Nd^{3+} lasers, (iv) initiation of PLG by an external source (injection of optical radiation), (v) the problem of covering a broad (including the UV) tuning range with organic lasers (OL) by nonlinear-optical methods, (vi) the possibility of building efficient OL with injection of external optical radiation, (vii) the design of electronically tuned OL around tunable acoustooptical filters (AOF). The authors stress that the pump source for all of the above lasing regimes and lasers is practically the same YAG-Nd^{3+} laser, which operates at high (up to 100 Hz or more) pulse repetition frequencies with Q-switching. Both the main radiation and second-harmonic (SH) radiation are used to pump the frequency converters. (19 refs.)

118159 CW Ar$^+$ laser pumped by an intense electron beam. T.Hara, Y.Sadamoto, M.Hamagaki, T.Ohgo, T.Dote (Inst. of Phys. & Chem. Res., Wako, Saitama, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L379-80 (July 1983).
Continuous-wave laser oscillation has been obtained on the 488.0 nm transition of singly ionized argon in a pure Ar plasma excited by a steady intense electron beam, of which energy and current can be independently controlled up to 300 eV and 11 A, respectively. This scheme has possibilities of increasing the efficiency, power and spectral range of ion lasers. (5 refs.)

118160 VPE-grown 1.3 μm InGaAsP/InP double-channel planar buried-heterostructure laser diode with LPE-burying layers. T.Yanase, Y.Kato, I.Mito, K.Kobayashi, H.Nishimoto, A.Usui, K.Kobayashi (Opto-Electronics Res. Lab. NEC Corp., Kawasaki, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L415-16 (July 1983).
Hydride-VPE grown 1.3 μm InGaAsP/InP double-channel planar buried-heterostructure laser diodes with LPE burying layers were fabricated. 19.5 mA CW threshold current, 47% external differential quantum efficiency, both at 25°C, 50 mW CW operation, high-temperature CW operation up to 120°C and threshold characteristic temperature T_0 as high as 72K, have been observed. (6 refs.)

118161 Selective meltbacked substrate inner-stripe AlGaAs/GaAs lasers operated under room temperature CW condition. K.K.S.Kinoshita, S.Konno, T.Tako (Res. Lab. of Precision Machinery & Electronics, Tokyo Inst. of Technol., Yokohama, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L473-5 (July 1983).
A novel lateral-mode controlled AlGaAs/GaAs inner-stripe laser is demonstrated which is fabricated by a one-step liquid phase epitaxial process using a newly developed selective meltback technique. The laser consists of V-groove substrate and six Al$_x$Ga$_{1-x}$As layers with different Al content forming a built-in rib-waveguide structure. In the fabrication, difference of meltback speed between GaAs and Al$_{0.5}$Ga$_{0.5}$As crystals was utilized. It was found that GaAs crystal was meltbacked rapidly by a factor of about fifteen compared with Al$_{0.5}$Ga$_{0.5}$As layer. The laser fabricated was operated under CW condition at 20°C with threshold current of 65 mA. (18 refs.)

118162 High-speed 1.55 μm single-longitudinal-mode ridge waveguide C^3 laser. I.P.Kaminow, J.-S.Ko, R.A.Linke, L.W.Stulz (Bell Labs., Crawford Hill Labs., Holmdel, NJ, USA).
Electron. Lett. (GB), vol.19, no.19, p.784-5 (15 Sept. 1983).
Fundamental-transverse-mode ridge waveguide laser chips were recleaved to form C^3 lasers with a single-longitudinal-mode output stabilised at a fixed wavelength over a wide range of drive currents and temperature. Lasers operated at 1.55 μm at a bit rate of 2 Gbit/s with on-off ratios greater than 10:1 and side-mode suppression greater than 1200:1. A simple method for mapping the stable operating regime is described. (12 refs.)

118163 Reliability of InGaAsP/InP buried heterostructure 1.3 μm lasers. K.Mizuishi (Central Res. Lab., Hitachi Ltd., Tokyo, Japan), M.Sawai, S.Todoroki, S.Tsuji, M.Hirao, M.Nakamura.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1294-301 (Aug. 1983).
A study was conducted of aging-induced Sn whisker growth at the surface of Au-Sn bonding solder layers around a laser chip, as well as metallurgical reactions, especially in p-side down lasers, at the interface of the solder and laser crystal just below the active layer. These phenomena cause electrical shorts in InGaAsP/InP laser diodes, which occur suddenly in devices operated for long periods without any previous symptoms having appeared in their aging characteristics. To completely eliminate such failures, a novel assembling method in which chips were mounted p-side up on semiinsulating SiC submounts using Pb-Sn solder was applied to InGaAsP/InP buried heterostructure (BH) lasers emitting at 1.3 μm. BH lasers assembled by this method do not suffer any shorting failure even after 8000 h operation under 60°C and 5 mW/facet output conditions. The small degradation rates obtained, for example 3 percent/kh (median) at 60°C, certify the reliability of these improved lasers. As long as the stripe width of the active layer was optimized to be in the range of 1.5-2.5 μm necessary for obtaining kink-free light output versus current properties, no detrimental changes in laser characteristics, including transverse and longitudinal modes and dynamic output response, were observed in aged lasers. The long-term degradation modes observed are presented, and possible causes are discussed. (16 refs.)

118164 Low-threshold InGaAsP ridge waveguide lasers at 1.3 μm. I.P.Kaminow, L.W.Stulz, J.S.Ko, A.G.Dentai, R.E.Nahory, J.C.De Winter, R.L.Hartman (Bell Labs., Holmdel, NJ, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1312-19 (Aug. 1983).
The ridge waveguide configuration is shown to provide reliable low-threshold fundamental-transverse-mode lasers that are readily fabricated. Two variants are described: in the simple ridge laser, the 1.3 μm bandgap active layer is sandwiched between InP layers and, in the cladded ridge, the active layer is surrounded by 1.1 μm bandgap InGaAsP. Thresholds as low as 34 mA and efficiencies as high as 66 percent are observed. Output power is linear to more than 12 mW. Several lasers have been operated at 30°C for over 1500 h without measurable degradation. Selected lasers exhibit stabilized longitudinal mode behavior over extended temperature and current ranges. The potential manufacturability of this device is its most attractive feature. (17 refs.)

118165 Narrow output line from a distributed-feedback dye laser with broad-spectrum pumping. I.A.Vabishchevich, A.D.Das'ko, A.N.Rubinov, S.A.Ryzhechkin, T.Sh.Efendiev, V.A.Yakovenko (Inst. of Phys., Acad. of Sci., Minsk, Belorussian SSR).
Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.567-8 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1316-19 (Nov. 1982). [received: Sept. 1983]
The authors report a new type of distributed-feedback dye laser, which can generate a narrow output line when pumped by a broad spectrum. This new laser is distinguished by its simplicity and low cost. It consists of a cell holding a dye solution, with a transmitting phase holographic grating on its entrance face. The pump beam is incident on this grating in the direction perpendicular to its surface, and as it leaves the grating it is split into three parts, corresponding to diffraction orders +1, 0, −1 (for the particular grating period used, there are no higher orders). (3 refs.)

118166 Atmospheric-pressure electroionization CO$_2$ laser using CO$_2$:N$_2$:H$_2$O mixtures. V.N.Borisov, L.N.Vitshas, I.V.Ishtykov, A.G.Krasyukov, I.D.Matyushchenko, V.G.Naumov, V.D.Pis'mennyi, L.V.Shachkin.
Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.570-1 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1323-6 (Nov. 1982). [received: Sept. 1983]
The authors report an experimental study of the energy characteristics of an atmospheric-pressure electroionization CO$_2$ laser using a CO$_2$:N$_2$:H$_2$O mixture and operating under single-pulse conditions. Ionization is provided by an electron beam with an energy of about 160 keV, which is injected through a 35-μm aluminum foil into the discharge chamber. The beam current density beyond the foil is $J_{e0} \simeq 5.0$ mA/cm^2. The working mixture is continuously blown through the discharge chamber to maintain a constant composition. The discharge current and the voltage across the discharge chamber are measured during the pulse by a standard method. In the experiments the authors used a two-pass telescopic unstable resonator with a magnification $M=1.5$; the length of the active medium along the optical axis of the resonator was 1.5 m. The output energy was measured with an array of EP-50 cells. (11 refs.)

118167 Characteristics of some gas discharge lasers. Harith Bin Ahmad. Univ. Wales, Swansea thesis, March 1983
A nitrogen laser was designed and constructed to be used as the pump source for a tunable dye laser system. Its characteristics such as its output power dependence on the applied voltage, on the pressures of the N$_2$ gas in the cavity and on the flow rate of the N$_2$ gas in the cavity have been studied. The temporal relationship between the optical output and the discharge current was investigated and it was found that lasing action occurred as soon as the current began to discharge between the laser electrodes. The measurement indicates that the mechanism of excitation of the nitrogen laser upper level (C $^3\Pi_u$-level) is due to the direct electron impact excitation of nitrogen molecules. The coherent ultraviolet output of 337.1 nm wavelength amounted to ~100 kW in 8 nanosecond flashes repeated at a pulse repetition rate of 4 Hz were observed in this 'home-made' laser. This 'home-made' nitrogen laser was used to pump a dye laser in order to produce coherent tunable wavelength output to be used to examine the optogalvanic effect. The efficiencies of various dyes (e.g. coumarin 500, rhodamine 6G and rhodamine B) were measured. Coherent visible light output powers of up to 10 kW in 5 ns flashes were obtained from the dye laser over the wavelength range from ~480 to 640 nm, i.e. from green to red.

Life test of 30 mW GaAlAs TAL laser grown by OMVPE .. See Entry 118139

Synthesis of the D$_2$O laser frequency ($\lambda=84$ μ) using a superconducting nonlinear device .... See Entry 118220

42.60D Laser resonators and cavities

118168 Coupled oscillator models of ring laser gyros. S.Stenholm.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.165-70 (1983).
The author shows that the basic features of frequency locking in ring laser gyros can be modelled by linear coupled oscillators. The two- and four-mode cases are treated. (14 refs.)

118169 Continuously coupled unstable resonators: problem of large output beam divergence. E.K.Gorton (Royal Signals & Radar Establ., Malvern, England).
Opt. & Laser Technol. (GB), vol.15, no.5, p.274-5 (Oct. 1983).
A problem which arises when one considers continuously coupled unstable resonators is that the beam divergence due to geometrical effects is usually large. The author describes a simple remedy which can be applied in most cases. (1 ref.)

Observation of self-induced Rabi oscillations in two-level atoms excited inside a resonant cavity: the ringing regime of superradiance .... See Entry 118108

Gain measurements on semiconductor lasers by optical feedback from an external grating cavity .... See Entry 118141

Pulsed YAG:Nd^{3+} laser with a passive *Q* switch in the form of an LiF crystal containing F_2^- centers .... See Entry 118152

Generation of single longitudinal mode pulses in passively *Q*-switched lasers via passive pre-lasing .... See Entry 118156

Atmospheric-pressure electroionization CO$_2$ laser using CO$_2$:N$_2$:H$_2$O mixtures . ... See Entry 118166

Controlling the length of ultrashort light pulses from a Q-switched ruby laser . ... See Entry 118179

42.60F Laser beam modulation

118170 Design of a pulse stacker. E.M.Hodgson, C.J.Reason, I.N.Ross (Central Laser Facility, Rutherford Appleton Lab., Chilton, Didcot, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.140-5 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The design of a simple pulse stacker is described. It enables pulses of variable duration in the nanosecond regime, and of predefined shape, to be synthesised from a short pulse. A pulse stacker of this type has been tested and used for laser compression experiments. (3 refs.)

118171 Laser pulse shaping with liquid crystals. J.A.Martin-Pereda, M.A.Muriel (Dept. de Electronica Cuantica, Ciudad Univ., Madrid, Spain).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.148-50 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A method of unpolarized laser pulse shaping is reported. The basis of the method is the use of a hybrid optical bistable device with nematic liquid-crystals. A sample of the input light controls, by an asymmetrical electronic comparator, a 1×2 electro-optical total switch. The output pulses are reshaped and maintain the same polarization properties as the input light. From triangular input light signals, symmetrical and asymmetrical output pulses have been obtained. The minimum pulse width achieved was 0.1 msec. A representation of the output versus input light signals gives a hysteresis cycle in the asymmetrical case. (3 refs.)

118172 Intelligent attenuator for laser pulse energy and power stabilization. M.S.White, R.W.Wyatt, A.G.Brett (Laser Div., Rutherford Appleton Lab., Chilton, Didcot, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.551-6 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Encouraging preliminary results are presented from a feedforward stabilized active optical filter. Its function is to greatly reduce the shot-to-shot and dat-to-day pulse energy fluctuations commonly suffered by single shot Q-switched lasers and their associated electro-optic gates and switchouts. (2 refs.)

118173 Actively mode-locked and Q-switched YAG laser with precise synchronizability. T.Tomie, T.Kasai, M.Yano (Electrotech. Lab., Agency of Industrial Sci. & Technol., Ibaraki, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L441-3 (July 1983).
A system is described which generates synchronizable laser pulses with low temporal jitter (≲30 ps). The conventional LC discharge pumping scheme is used. The laser is actively mode-locked by an A-O modulator and Q-switched by a Pockels cell. Pulses of various widths (200 ps~1 ns) can be obtained with the use of intra-cavity etalons and variation of the RF power to the A-O modulator. The stability of the pulse energy is very high (~3%). (6 refs.)

118174 Two-dimensional simulation of a plasma KrF pulse compressor. R.Marchand, C.E.Capjack, C.R.James (Dept. of Electrical Engng., Univ. of Alberta, Edmonton, Alberta, Canada).
J. Appl. Phys. (USA), vol.54, no.9, p.4844-52 (Sept. 1983).
Results from a two-dimensional simulation of a KrF laser pulse compression to parameters relevant to laser-driven fusion are presented. The amplifying medium consists of a fully ionized hydrogen plasma cylinder. The plasma density can be adjusted so as to radially confine the laser beams and thus, alleviate the constraints on the input beam divergences. Energy transfer efficiencies of order 50% are possible for experimentally feasible laser and plasma parameters. (10 refs.)

118175 Rare earth Faraday rotator materials for lasers. M.J.Weber, E.Hildum, S.Leung, R.Morgret (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.276-7 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
Summary form only given. Optical switches, modulators and isolators based on Faraday rotation are used in various laser systems. Important considerations for Faraday rotator materials in laser applications are the Verdet constant, the transmission (small absorption and scattering losses), the non-linear refractive index (for high power lasers where self-focusing must be controlled) and the cost. The best Faraday rotator materials for most high power lasers operating at visible or near-visible wavelengths are paramagnetic materials consisting of rare earth ions in hosts with low refractive indices. For general use, rare earths with low-lying 5d bands and a large range of transparency are most attractive; ions satisfying these criteria include Ce^{3+}, Pr^{3+}, Tb^{3+} and Eu^{2+}. In the search for improved materials the Verdet constants at optical wavelengths were measured for rare earths in many different hosts including oxide and fluoride crystals and glasses. (1 ref.)

118176 Amplitude modulation of the radiation of a CO$_2$-laser by optically controlled absorption in semiconductors. B.F.Kuntsevich, A.N.Pisarchik, V.N.Chizhevskii, V.V.Churakov.
J. Appl. Spectrosc. (USA), vol.38, no.1, p.107-12 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.126-33 (Jan. 1983).
The authors describe the results of an experimental investigation of in-resonator amplitude modulation of the emission CW CO$_2$ laser ($\lambda=10.6$ μm) by controlled absorption by nonequilibrium carriers in semiconductor plates of Ge and GaAs. The emission of a ruby and neodymium laser was used as the controlling (modulating) signal acting on the semiconductor plate. (14 refs.)

118177 Self-modulation of radiation in a single-pulse ruby laser. V.I.Lebedev, V.A.Yurevich, A.I.Yansen'.
J. Appl. Spectrosc. (USA), vol.38, no.1, p.113-18 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.133-8 (Jan. 1983).
The authors examine the possibility of shortening the leading edge and the total duration of a single pulse due to spontaneous variation of the Q-factor of a narrow-band selective resonator, occurring with frequency drift of the generated radiation. (8 refs.)

118178 Ultrashort optical pulse generation from microwave modulated AlGaAs diode laser with Selfoc rod resonator. Y.Tada, H.Yokoyama, H.Ito, H.Inaba (Res. Inst. of Electrical Communication, Tohoku Univ., Sendai, Japan).
Opt. Commun. (Netherlands), vol.47, no.3, p.187-9 (1 Sept. 1983).
Experimental studies were carried out to demonstrate practical feasibility for generating high-bit-rate ultrashort optical pulses from RF modulated AlGaAs diode lasers using compact Selfoc rod lens external resonators mounted on the brass heat sink for the diode laser. Measured pulse width was found to be ≈37 ps with a Lorentzian profile at modulation frequencies of 1.4 and 3.6 GHz depending on the length of the Selfoc rod lens. Evidence for regenerative amplified pulse oscillation was also obtained at 3.6 GHz repetition rate with this external cavity configuration. (16 refs.)

118179 Controlling the length of ultrashort light pulses from a Q-switched ruby laser. A.S.Kuch'yanov, V.A.Labusov, V.D.Ugozhaev, K.G.Folin (Inst. of Automation & Electrometry, Acad. of Sci., Novosibirsk, USSR).
Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.557-8 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1296-9 (Nov. 1982). [received: Sept. 1983]
The possibilities of solid state lasers as sources of ultrashort light pulses have not been fully realized by the methods which are commonly used to produce the pulses. The authors report an experimental study of a method for controlling the length (t_p) of ultrashort pulses which presents the possibility, in principle, of adjusting this length over the range $T_{2x} \gtrsim t_p \gtrsim \Delta\nu_g^{-1}$ with completely reproducible pulse characteristics t_p (T_{2x} is the axial period, and $\Delta\nu_g$ is the spectral gain width of the active medium of the laser). This method combines two other methods, which have been studied previously. The first of the component methods is the injection of an initial pulse into the resonator of a solid-state laser with a saturable absorber. The second component method is to introduce a fixed additional loss in the laser resonator at a certain stage in the generation. This additional loss essentially cancels the change in the peak intensity I_{peak} over a time interval sufficient for the saturable absorber to shorten the initial pulse to the necessary length. The shortening of t_p occurs most effectively if $I_{peak} \sim I_s$; I_s is the saturation intensity of the saturable absorber. (6 refs.)

Pulse-broadening mechanism in injection mode-locked TEA CO_2 lasers .... See Entry 118114

Pulsed YAG:Nd^{3+} laser with a passive *Q* switch in the form of an LiF crystal containing *F*$_2^-$ centers .... See Entry 118152

Generation of single longitudinal mode pulses in passively *Q*-switched lasers via passive pre-lasing .... See Entry 118156

Measurement of spectra of and correlation between FM and AM noises in GaAlAs lasers .... See Entry 118186

Image-converter recording of picosecond pulses emitted by an erbium laser (λ=2.94 μ) with active mode locking .... See Entry 118190

Second harmonic generation in a YAG laser with self-locking of longitudinal modes .... See Entry 118219

Calibrated grating attenuator .... See Entry 118262

Optical tuning of a tellurium cavity—optical modulation and determination of semiconductor parameters .... See Entry 118265

42.60H Optical problems related to properties and interactions of laser beams

118180 A new approach to the generation of high-power nanosecond pulses in CO_2 lasers. A.J.Alcock, V.V.Apollonov, P.B.Corkum, R.S.Taylor (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.98-102 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1677-82 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
Describes a new approach to the isolation of a powerful nanosecond pulse in a CO_2 laser system which consists of combining mode locking in injection of a weak signal with saturation effects in absorbing media such as SF_6 and induced reflection or absorption right at the surface or in the interior of a semiconductor illuminated by an external source. Taken together, these effects can be used to obtain a reliable method for selection of short pulses with high output characteristics and have great potential for construction of a simple and highly efficient gas-laser system that generates short high-power pulses of radiation. (13 refs.)

118181 Active media of solid-state lasers. V.V.Osiko, A.M.Prokhorov, I.A.Shcherbakov (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.115-28 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1698-715 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
Discusses certain new trends that have arisen in the development and application of solid active media to obtain significant increases in the energy parameters of solid-state lasers and have led to the development of miniature lasers with active-medium volumes of <1 mm^3 and the creation of tunable solid-state lasers. (66 refs.)

118182 Review of laser induced damage thresholds. R.M.Wood, S.K.Sharma, P.Waite (General Electric Co. plc, Hirst Res. Centre, Wembley, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.84-7 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Reviews the mechanisms by which laser damage occurs and summarises the forms of the resulting damage which have been observed, with examples at both 1.064 and 10.6 μm. Summaries of the laser induced damage threshold measurements made on a wide range of materials, windows, mirrors and optical components are presented at both wavelengths. (3 refs.)

118183 Quantitative measurement of energy deposited in optical coatings. R.T.Bailey, F.R.Cruickshank, D.Pugh (Dept. of Pure & Appl. Chem., Univ. of Strathclyde, Glasgow, Scotland), A.McLeod.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.88-9 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982)
The measurement of energy deposited in optical coatings on windows or mirrors is necessary for the nondestructive estimation of damage thresholds which are of particular significance in laser optics. Such measurements are very difficult to perform by observing energy loss from a light beam incident on the optical element, since the absorbed energy is very low (p.p.m. range) and at these levels absorption and scattering of the light are difficult to quantify separately. The technique described offers a sensitive, noninvasive approach to calculating peak temperatures reached at the surface of the element under pulsed conditions. Results are reported for a variety of mirror surfaces and substrates. (3 refs.)

118184 Window and mirror materials for use at 10.6 micron. S.K.Sharma, P.Waite, R.M.Wood (General Electric Co., plc, Hirst Res. Centre, Wembley, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.104-9 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The most common laser window and mirror materials for use at 10.6 μm are discussed and compared. Metal mirrors have been shown to yield high reflectance and high damage thresholds. Dielectrically coated mirrors yield ultra-high reflectances but lower damage thresholds due to coating defects. The window operational characteristics depend both on the coating and on the window substrate material. The range of available 10.6 μm transmitting substrates are discussed, their parameters analysed and their operational faults highlighted. (4 refs.)

118185 Laser induced damage in the ultraviolet. S.S.Wiseall, D.C.Emmony (Dept. of Phys., Loughborough Univ. of Technol., Loughborough, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.521-6 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
An ultra-violet laser damage and diagnostic facility has been set up. Laser induced damage threshold measurements have been made at 193 nm and 248 nm on a range of UV substrate/window materials such as fused silica, MgF_2, CaF_2 and on various excimer laser mirrors with multilayer dielectric coatings. (6 refs.)

118186 Measurement of spectra of and correlation between FM and AM noises in GaAlAs lasers. K.Kikuchi, T.Okoshi (Dept. of Electronic Engng., Univ. of Tokyo, Tokyo, Japan).
Electron. Lett. (GB), vol.19, no.20, p.812-13 (29 Sept. 1983).
The FM- and AM-noise spectra of a CSP-type GaAlAs laser, and the correlation between FM and AM noises, are measured in the frequency range below 100 kHz with the bias current as a parameter. The measured spectra consist of power-independent $1/f$ noise and power-dependent white noise components. A strong correlation is observed between the FM and AM noises when the output power is small. This fact supports the theory developed by Henry (see IEEE J. Quantum Electron., vol.QE-18, no.2, p.259-64, 1982) in which the amplitude-phase coupling causes the linewidth increase. (6 refs.)

118187 Spectrophone stabilization and offset tuning of a carbon dioxide waveguide laser. M.J.Kavaya, R.T.Menzies, U.P.Oppenheim (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1234-8 (Aug. 1983).
A sensitive spectrophone containing CO_2 gas is incorporated into a feedback loop to stabilize the frequency of a CO_2 waveguide laser. First or second harmonic detection combined with a zero offset feature and the relatively high operating pressure of the laser allows continuous tuning of the stabilized frequency over a 400 MHz range. Frequency stability of better than ±1 MHz is achieved. (9 refs.)

118188 Spectral quality of He-Zn II and He-Cd II hollow cathode metal vapor lasers in the magnetic fields. W.Sasaki (Dept. of Electronics, Doshisha Univ., Kyoto, Japan), H.Ueda, T.Ohta.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1259-69 (Aug. 1983).
Reports the magnetic characteristics of the oscillation in the axial and transverse magnetic fields derived from the measurements for the oscillation spectra in the 492.4 nm He-Zn II, and in the simultaneously operating 537.8 and 636.0 nm He-Cd II hollow cathode lasers. The simultaneous oscillation in the He-Cd II lasers is compared to the monochromatic one in each wavelength. The experimental data in the magnetic fields are well explained by the theoretical treatment including not only Zeeman effects but also the plasma effects in which the excitation mechanisms are considered using the rate equations. The electron density in the laser plasma that depends on the magnetic fields play an important role in the excitation mechanisms. This paper proposes that the magnetic characteristics will be used for the color control of a white light laser as well as for the improvement of the monochromaticity in the anomalously broadened lasers. (9 refs.)

118189 Observation of intensity fluctuations and mode correlations in a broadband CW dye laser. L.A.Westling, M.G.Raymer (Inst. of Optics, Univ. of Rochester, Rochester, NY, USA), M.G.Sceats, D.F.Coker.
Opt. Commun. (Netherlands), vol.47, no.3, p.212-17 (1 Sept. 1983).
The authors have studied the intensity fluctuations of a free running, broadband, standing-wave CW dye laser. The intensity autocorrelation function has been measured using a frequency-doubling autocorrelator with picosecond time resolution. The measurements at low laser powers reveal the development of stable mode correlations through spatial hole burning. These mode correlations are found to disappear abruptly as the laser power is increased above a critical point. A model for describing these mode correlations and the transition to uncorrelated behavior is presented. (16 refs.)

118190 Image-converter recording of picosecond pulses emitted by an erbium laser (λ=2.94 μ) with active mode locking. K.L.Vodop'yanov, N.S.Vorob'ev, L.A.Kulevskii, A.M.Prokhorov, M.Ya.Shchelev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.272-4 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.471-2 (March 1983). [received: Oct. 1983]
An image converter with a silver-oxygen-cesium photocathode (the red edge of the photoelectric effect was $\sim$1.3 μ) was used to determine the time characteristics of single picosecond pulses emitted by an erbium laser at the fundamental frequency (2.94 μ) and at the second harmonic (1.47 μ). The duration of the photoresponse in the case of the fundamental-frequency pulses was 45 psec and the threshold sensitivity of the system was 10^8 W/cm^2. It was found that the photoresponse of the image converter was strongly nonlinear. (5 refs.)

118191 Continuous tuning of the frequency of an NH_3 laser within the gain profile. M.Akhrarov, B.I.Vasil'ev, A.Z.Grasyuk, A.B.Yastrebkov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.357-61 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.602-7 (March 1983). [received: Oct. 1983]
Continuous frequency tuning was achieved for an NH_3 laser mixture above atmospheric pressure over a range of $\sim$0.25 cm^{-1} in the vicinity of the frequency ν_L=868 cm^{-1}. Measurements were made of the fine structure of the laser emission line due to the $sP(5,k)$ transition and of the widths of the NH_3 laser lines due to the $sP(5,k)$ and $aP(5,3)$ transition at various active-medium pressures. (9 refs.)

118192 Effects of multiple interaction in laser damage to optical materials. B.G.Gorshkov, Yu.K.Danileiko, V.N.Nikolaev, A.V.Sidorin (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.388-91 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.640-3 (March 1983). [received: Oct. 1983]
The relationship between the physical damage mechanisms in the case of single and multiple interaction is discussed. The results are reported of an experimental investigation of the process of bulk damage to optical materials as a result of repeated interaction with pulsed laser radiation (λ=1.06 μ, $\tau \approx$15 nsec). (15 refs.)

Elastic collision cross sections for laser-induced diffusion ..... See Entry 117970

Present status of holographic laser beam dynamic correction methods .... See Entry 118094

Dynamic phase hologram for laser beam steering .... See Entry 118102

Gain measurements on semiconductor lasers by optical feedback from an external grating cavity .... See Entry 118141

Gain and carrier lifetime measurements in AlGaAs single quantum well lasers .... See Entry 118142

Pulsed YAG:Nd^{3+} laser with a passive Q switch in the form of an LiF crystal containing F_2^- centers .... See Entry 118152

Continuously coupled unstable resonators: problem of large output beam divergence .... See Entry 118169

Intelligent attenuator for laser pulse energy and power stabilization .... See Entry 118172

Optical properties for an antireflection-coated LD optical switch .... See Entry 118194

Measuring methods to control a high power CO_2 laser beam for material processing .... See Entry 118196

Propagation of laser radiation in a moving delayed-response nonlinear medium .... See Entry 118202

Efficient conversion of visible radiation from a tunable dye laser to the ultraviolet range .... See Entry 118222

Efficient up-conversion of a CO_2 laser frequency in sodium vapor .... See Entry 118224

Wavefront inversion and the problem of shaping the structure of laser radiation .... See Entry 118226

Control of laser beams in nonlinear media. Problems of suppressing nonlinear distortions .... See Entry 118232

Optical materials for CO_2 lasers .... See Entry 118236

A fast electro-optic focusing device .... See Entry 118254

Single mode laser spectral spread repercussion in single-mode optical fiber coherent detection systems .... See Entry 118277

Influence of the polarization of injection laser radiation on the efficiency of the acoustooptic interaction in anisotropic crystals .... See Entry 120022

Scintillation of laser radiation due to propagation through atmospheric turbulence, measurements, and theoretical calculations .... See Entry 121370

Investigation of the absorption of radiation emitted from a tunable CO_2 laser by water vapor in the range 9-11 μ .... See Entry 121372

42.60K Optical problems related to applications of laser beams

118193 Use of the laser interferometer in the calibration of numerically controlled machine tools. H.Tipton (Machine Tool Industry Res. Assoc., Macclesfield, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.376, p.15-19 (1983). (Optical Sensing Techniques, Benefits, Costs, Teddington, Middx., England, 7-8 Dec. 1982).
The laser interferometer is ideal for calibrating the linear axes of machine tools but it is not so easy to develop a satisfactory test procedure to yield values of accuracy and repeatability as might at first be expected. This problem is being studied by an ISO working group and some of the problems which arise are discussed. (4 refs.)

118194 Optical properties for an antireflection-coated LD optical switch. M.Ikeda (Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
Electron. Lett. (GB), vol.19, no.20, p.826-8 (29 Sept. 1983).
Measured optical properties for an antireflection-coated laser-diode optical switch are described. With antireflection coatings, output level stability for injection current and temperature are much improved. The input and output signal spectra are the same. (6 refs.)

118195 Production of deformed grating patterns by laser-scanning and some applications. T.Yoshizawa, H.Tashiro.
J. Jpn. Soc. Precis. Eng. (Japan), vol.49, no.6, p.698-702 (June 1983). In Japanese.
A trial is reported on producing deformed lines of an object scanned by a laser beam, that is so-called deformed grating patterns. Such properties inherent in a laser beam as being narrow in width and high in intensity can be effectively utilized for this purpose. With the aim of getting appropriate patterns, geometrical relations between a rotating mirror and an incident light are investigated, and a practical scanning apparatus is devised and manufactured as a prototype. The photographic pattern of the object with deformed grating lines reveals Moire fringes showing contour mapping when superimposed by a reference grating. Experimental applications with one pair of these patterns show that cross sections of the object can be drawn and that piling up these sections can reproduce the original shape of the subject body. (7 refs.)

118196 Measuring methods to control a high power CO_2 laser beam for material processing. R.Rothe, W.Juptner, G.Sepold (Bremer Inst. fur Angewandte Strahltech., Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.439-44 vol.1
CO_2-lasers of the multi-kilowatt-range are increasingly used for welding, cutting, hardening and alloying materials. The results of these procedures are dependent on intensity and its distribution across the laser beam. Two similar novel techniques are presented to measure these beam data simply and economically. In both cases the beam is mechanically scanned by small metallic mirrors or a rotating disk with bores similar to a Nipkow-disk. The scanned part of the laser beam is converted to analogue electrical signals. (no refs.)

Direct microscopic and microholographic observations of the solidification of particles from rapidly stirred melts .... See Entry 117226

Rigorous diffraction theory applied to video disk geometries .... See Entry 118068

Coupled oscillator models of ring laser gyros .... See Entry 118168

Coherent-optical control of the quality and shape of reflecting objects .... See Entry 118313

The theory and apparatus of laser interferometric centring .... See Entry 118314

Gain and loss kinetics in a pulsed discharge by scanning in time with a probing laser pulse .... See Entry 118759

Advances in surface inspection using on-line image processing .... See Entry 120588

The description of detecting signals by laser scanning optoacoustic microprobe [solar cells testing application] .... See Entry 120747

Laser speckle technique for the visualization of retinal blood flow .... See Entry 120849

Eye deformation measurement by laser interferometry .... See Entry 120977

Recent advances in laser fluorescence microscopy .... See Entry 121063

Use of lasers in hydrometeorological research and for environmental monitoring .... See Entry 121382

42.65 NONLINEAR OPTICS

118197 Opto-optical light deflection. G.Roosen, G.T.Sincerbox (IBM Res., San Jose, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.564-9 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Light deflection is obtained by diffraction from a transient index modulation established as a grating of variable frequency by the interference of two light beams in an optical material. The authors describe a technique for altering the grating frequency by shifting only the wavelength of the control beams and the use of a novel optical system to maintain the Bragg condition over a wide range of frequencies in order to achieve light deflection without loss in efficiency. A computer simulation permits one to test various designs and to select the best configurations with emphasis on those that exhibit large angular deflections with minimum Bragg detuning. This new method of light deflection allows either discrete or continuous light scanning or modulation. The experimental results confirm the calculations and the authors have obtained angular deflection changes larger than 11 degrees from a wavelength shift smaller than 30 nm while maintaining the Bragg condition. (4 refs.)

118198 Line narrowing effect in fully resonant four wave mixing spectroscopy in solids. H.Souma (Dept. of Chem., Univ. of Pennsylvania, Philadelphia, PA, USA).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3225-32 (Sept. 1983).
The author explains the utility of third-order nonlinear susceptibility, $\chi^{(3)}(\omega_2; \pm\omega_1, \mp\omega_1, \omega_2)$ for the observation of resonances with homogeneous widths from inhomogeneously broadened distributions in three-level systems related to Raman or two-photon allowed electronic transitions. The line narrowing and high resolution capabilities are demonstrated theoretically using a model for inhomogeneous distributions of transitions in which the author regards an absorption spectrum as the composition of some inhomogeneously broadened substructures. The experimental methods to separate a signal having frequency ω_2 from ingoing beam at the same frequency are outlined.

118199 Picosecond shadow spectroscopy and refractive-index nonlinearity in semiconductors. V.P.Gribkovskii, V.A.Zyul'kov.
J. Appl. Spectrosc. (USA), vol.38, no.1, p.16-25 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.21-6 (Jan. 1983).
Refractive-index nonlinearity is examined by picosecond shadow spectroscopy. The essence of the method is as follows: a single picosecond laser pulse produces a region of optical inhomogeneity in the semiconductor, which is then probed by a picosecond white-light pulse. The ultrashort high-power excitation produces a large change in the refractive index, while the picosecond continuum as the probe radiation provides shadow photographs of the excited region at various wavelengths and at various times after the laser pulse. One measures the spatial distribution of the probe radiation in the plane of the detector to determine the relative refractive-index change in the excited region, while the delay of the probe beam relative to the exciting one enables one to examine the time course of the effect. Single crystals CdS, ZnTe, ZnSe, ZnS, GaP are studied. (3 refs.)

118200 Self-pulsing in two-cavity optical bistability. J.S.Satchell, C.Parigger, W.J.Sandle (Dept. of Phys., Univ. of Otago, Dunedin, New Zealand).
Opt. Commun. (Netherlands), vol.47, no.3, p.230-5 (1 Sept. 1983).
The authors discuss two serially coupled ring cavities which contain media modeled by an ensemble of homogeneously broadened two-state atoms. This system produces pulsed outputs for appropriate CW inputs and values of the cooperativity parameters in the absorbtive regime. In particular, self-pulsing occurs when both stable and unstable steady-state output versus input characteristics are everywhere monotomic with positive slope. An analytic requirement for this self-pulsing is obtained in the absorptive case. (13 refs.)

SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82 .... See Entry 116913

Transient effects, transverse mode coupling, and diffraction in swept-gain superradiance in the nonlinear regime: evolution from the superradiant state .... See Entry 118105

Experimental investigation of inhomogeneously pumped injection lasers .... See Entry 118148

Optical tuning of a tellurium cavity—optical modulation and determination of semiconductor parameters .... See Entry 118265

Coherent polarization methods of nonlinear spectroscopy of a gas in a longitudinal magnetic field .... See Entry 118708

Nonlinear plasma spectroscopy of the hydrogen Balmer-α line .... See Entry 118750

Nonlinear effects in the electron-nuclear spin system of a semiconductor following absorption of light of variable circular polarization .... See Entry 119953

Quality of ADP crystals formed by rapid growth from a point-like seed .... See Entry 120235

42.65B General theory

118201 Nonlinear reflection of elliptically polarized light. G.B.Altshuller, V.S.Ermolaev, V.B.Karassev, S.A.Kozlov, K.I.Krylov (Leningrad Inst. of Fine Mech. & Optics, Leningrad, USSR), L.I.Pavlov.
Appl. Phys. B (Germany), vol.B32, no.2, p.97-100 (Oct. 1983).
Nonlinear reflection of elliptically polarized light waves from the interface of two isotropic transparent media is investigated for the first time. Nonlinear Fresnel formulae are obtained. It is shown that when linear refractive indices are equalized, selfdeformation of the polarization ellipse in nonlinear reflection depends only on incident light ellipticity, not upon its intensity and the angle of incidence. (8 refs.)

118202 Propagation of laser radiation in a moving delayed-response nonlinear medium. K.S.Gochelashvili, I.V.Chashei, V.I.Shishov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.410-12 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.666-9 (March 1983). [received: Oct. 1983]
A derivation is given of the second-order coherence function for the propagation of laser radiation in a moving delayed-response nonlinear medium. A

solution of this equation is used in an asymptotic analysis of fluctuations of the radiation in the case of propagation over long distances. (4 refs.)

42.65C Stimulated Raman, Brillouin and Rayleigh scattering; parametric oscillations and harmonic generation

118203 Conversion of pump radiation in luminescent substances. P.P.Pashinin, V.M.Podagaetskii (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.110-4 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1691-7 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
Possibilities for increasing the efficiencies of lasers by conversion of pump radiation in the wavelength range in which the active media absorb are discussed. Two model variants of pump-radiation converters are considered. (10 refs.)

118204 Parametric upward frequency conversion of picosecond IR pulses. B.S.Azimov, Yu.N.Karamzin, V.F.Kotov, A.K.Sukhorukova (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.129-31 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1716-19 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
The authors discuss nonstationary generation of radiation at the sum frequency in a low-frequency pump field. The spectral width and shape of the excited radiation and the efficiency of the converter are investigated. Regimes in which a high-frequency wave is excited are classified on the basis of the type of manifestation of nonlinear and dispersion effects discuss the influence of second-order dispersion effects: the dispersion broadening of short pulses. (5 refs.)

118205 Present state of research and development in nonlinear-optical frequency conversion. V.D.Volosov, V.L.Strizhevskii.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.142-59 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1733-53 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
The authors outline the characteristic trends of recent years, looking specifically at generation of optical harmonics and optical-frequency mixing in crystals, multiplication and mixing of optical frequencies in gaseous nonlinear-optical media and stimulated Raman scattering (SRS) lasers. (148 refs.)

118206 The temperature dependence of coherent two-photon processes in naphthalene in the strong exciton-photon coupling regime. S.H.Stevenson, G.J.Small (Dept. of Chem., Iowa State Univ., Ames, IA, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.334-9 (16 Sept. 1983).
Temperature-dependent intensity data for two-photon excitation and second harmonic generation signals phase matched onto the polariton branches of the singlet *a*-exciton of naphthalene are presented. The data are shown to be in qualitative agreement with the polariton fusion model which accounts for strong exciton-photon coupling. In this model the polariton scattering frequency and group velocity determine the branching ratios for the above signals. (25 refs.)

118207 Fast beam deflectors based on phase matching. I.Filinski, T.Skettrup (Phys. Lab. III, Tech. Univ. of Denmark, Lyngby, Denmark).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.345-9 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The second harmonic beam in a phase matched frequency doubler crystal travels in the direction of phase matching. If the wavelength of a focused fundamental beam is changed, the phase matching direction is changed and the harmonic beam is deflected. The deflection angle and number of pixels are derived. Experimental results on a $LiIO_3$-crystal are presented. With electro-optic wavelength tuning very fast scanners (up to 10^{10} pixels/sec) can be constructed. Changes of the phase matching direction can also be obtained via the electro-optic effect. This effect is investigated, and it is found that this effect is too small for the usual nonlinear electro-optic crystals, but can be of practical importance for the nonlinear organic crystals recently discovered. (5 refs.)

118208 Generation of extreme ultraviolet radiation at 79 nm by sum frequency mixing. T.Srinivasan, H.Egger, H.Pummer, C.K.Rhodes (Dept. of Phys., Univ. of Illinois, Chicago, IL, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1270-6 (Aug. 1983).
High brightness tunable coherent extreme ultraviolet (XUV) radiation at 79 nm with a peak power of $\sim$200 mW has been generated in H_2 gas by sum frequency mixing of two quanta from a high spectral brightness ArF* (193 nm) source with one quantum from a tunable dye laser ($\sim$436 nm). Spectroscopic application of this radiation has been demonstrated by observation of a broad ($\sim$160 cm^{-1}) autoionizing structure in Ar and narrow ($\sim$2 cm^{-1}) autoionizing features in D_2. An analysis is given which identifies the dominant molecular states involved in the nonlinear susceptibility of the medium (H_2). The frequency independent tuning behavior of the 79 nm output power observed over $\sim$300 cm^{-1} is related to the molecular structure and response of the nonlinear medium in the intense optical field. (36 refs.)

118209 Effect of group velocity mismatch on the measurement of ultrashort optical pulses via second harmonic generation. A.M.Weiner (Dept. of Electrical Engng. & Computer Sci., MIT, Cambridge, MA, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1276-83 (Aug. 1983).
The use of second harmonic generation as a technique for optical pulse width measurements is analyzed to determine the effects of both phase velocity and group velocity mismatch between fundamental and second harmonic fields. An expression for the time average second harmonic energy, which except for special cases differs from the intensity autocorrelation function, is derived. For Type I phase matching, the measurement yields an apparent correlation width which can be either shorter or longer than the actual intensity correlation width, depending on the specific pulse shape. When the group velocity mismatch is nonzero, the measurement becomes sensitive to the phase matching condition. Two special pulse shapes for which the measurement is independent of group and phase velocity mismatch are the Gaussian and the single-sided exponential. (14 refs.)

118210 Degenerate four wave mixing with long range surface plasmons in attenuated total reflection geometries. G.I.Stegeman, C.Karaguleff (Arizona Res. Labs., Univ. of Arizona, Tucson, AZ, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.4853-5 (Sept. 1983).
The authors analyze the theory of degenerate four wave mixing by long range surface plasmons in an attenuated total reflection geometry. It is shown that large signal levels can be obtained with pulsed laser excitation for polydiacelyne materials. (18 refs.)

118211 Optical second harmonic generation in gases in magnetic field. H.Uchiki, H.Nakatsuka, M.Matsuoka (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3010-18 (Sept. 1983).
The authors analyze second harmonic generation in sodium vapor in a transverse magnetic field induced by the two-photon resonant excitation of the 3S-3D transition. The phenomenon is explained by the rotation of the two-photon induced quadrupole moment in the magnetic field. The analysis explains well the saturation of the intensity and rotation of the polarization of the second harmonic radiation in the higher magnetic field $\gtrsim$0.5 kG. The collisional decay rate of the coherence of the E1 forbidden transition has been measured as an application of this SHG.

118212 Non-linear susceptibility of Langmuir-Blodgett polydiacetylene thin films. F.Kajzar (DEIN/LERA, CENS, Gif-sur-Yvette, France), J.Messier, J.Zyss.
J. Phys. Colloq. (France), vol.44, no.C-3, p.709-12 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Third harmonic generation from thin films of polydiacetylene has been measured by transmission at 1.06 μm fundamental wavelength. The measured harmonic light intensity increases quadratically with the polymer film thickness up to about 0.5 μm. For two studied isomorphic forms of polydiacetylene ('blue' and 'red') one finds nearly the same value of nonlinear susceptibility $\chi^{(3)} \sim 1.3 \times 10^{-12}$e.s.u. (7 refs.)

118213 Optical second harmonic generation in various liquid crystalline phases. M.I.Barnik, L.M.Blinov, A.M.Dorozhkin, N.M.Shtykov (Organic Intermediates & Dyes Inst., Moscow, USSR).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.1-12 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The zero-field and field-induced optical second harmonic generation (SHG) was investigated for the nematic and smectic A phases of various liquid crystals. The components of the cubic non-linear susceptibility tensor were measured for substances with different molecular structure. The phase-matched SHG was observed for all the compounds investigated. The directions of the phase synchronisms as well as the corresponding non-linear susceptibilities were determined for the ee-o and oe-o interactions. The zero-field phase-matched SHF was observed for the oe-o interaction. It was accounted for by a multipolar mechanism. (19 refs.)

118214 Second-harmonic generation at interfaces. G.A.Reider, A.J.Schmidt (Abteiling fur Quantenelektronik und Lasertech., Tech. Univ. Wien, Wien, Austria), G.Marowsky.
Opt. Commun. (Netherlands), vol.47, no.3, p.223-5 (1 Sept. 1983).
Second-harmonic light can be generated at dye coated surfaces of fused silica. By changing either the angle of incidence or the frequency of the fundamental, phase matching of signals produced at the two surfaces of a plane parallel plate has been achieved. The interaction of light from multiple internal reflections has also been studied. (5 refs.)

118215 Ultraviolet four-photon mixing in a multimode silica fiber Raman amplifier. R.Pini, R.Salimbeni (Istituto di Elettronica Quantistica, CNR, Florence, Italy), M.Matera, C.Lin.
Opt. Commun. (Netherlands), vol.47, no.3, p.226-9 (1 Sept. 1983).
Efficient frequency conversion of the XeF excimer (351.2 nm) by nonlinear effects in a highly multimode silica fiber is reported. Besides a substantial Raman amplification of the weaker XeF line at 353.3 nm, stimulated four-photon mixing has also been observed, generating a Stokes peak at 355.5 nm with a 1 kW peak power. (6 refs.)

118216 Generation of tunable single-frequency continuous-wave coherent vacuum-ultraviolet radiation. A.Timmermann (Inst. fur Atom- und Festkorperphys., Freie Univ. Berlin, Berlin, Germany), R.Wallenstein.
Opt. Lett. (USA), vol.8, no.10, p.517-19 (Oct. 1983).
Tunable single-frequency continuous-wave coherent VUV radiation is generated at $\lambda_{VUV}=143.6$ nm by resonant frequency tripling in Mg. The frequency of the output of a frequency-stabilized dye ring laser (spectral width $\Delta\nu < 1$ MHz) is tuned to the two-photon transition $3s^2\ {}^1S_0$-$3s3d\ {}^1D_2$ ($\lambda=430.9$ nm) of Mg. A laser power of 0.2 W produces at the third harmonic more than 1.2×10^5 photons/sec (1.8×10^{-13} W). Radiation generated by this method will provide laser VUV spectroscopy of highest spectral resolution. (20 refs.)

118217 Observation of solitons in stimulated Raman scattering. K.Druhl (Inst. for Modern Optics, Univ. of New Mexico, Albuquerque, NM, USA), R.G.Wenzel, J.L.Carlsten.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1171-4 (26 Sept. 1983).
Anomalous pump-depletion reversal in stimulated Raman scattering has been observed and is interpreted as the experimental findings are presented and compared with the analytical solutions to the undamped stimulated Raman scattering equations as well as with a numerical study of the damped equations. (9 refs.)

118218 Competition between stimulated Brillouin scattering and optical breakdown in argon. S.B.Papernyi, V.F.Petrov, V.A.Serebryakov, V.R.Startsev.
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.293-7 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.502-9 (March 1983). [received: Oct. 1983]
Measurements were made of the dependences of the stimulated Brillouin scattering (STBS) threshold and of the gain *g* (cm/MW) on the pressure of argon. The influence of the focusing geometry on the process of competition between STBS and optical breakdown was studied. The influence of breakdown on STBS was described by introducing effective nonlinear losses proportional to the intensity of the pump radiation. Within the framework of this approach a good agreement was obtained between the experimental and theoretical results. (19 refs.)

118219 Second harmonic generation in a YAG laser with self-locking of longitudinal modes. A.A.Gusev, S.V.Kruzhalov, B.V.L'vov, L.N.Pakhomov, V.Yu.Petrun'kin (M.I Kalinin Polytech. Inst., Leningrad, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.322-8 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.547-57 (March 1983). [received: Oct. 1983]
A theory is developed of intracavity second harmonic generation in multimode continuously pumped lasers with a homogeneously broadened gain profile. An analysis is made of the amplitude distribution and phase relationships between the generated modes. A theoretical and experimental study is reported of the spontaneous establishment of frequency modulation of the output radiation of a YAG laser with self-locking of longitudinal oscillation modes and intracavity frequency doubling. The conditions for the occurrence of this effect are

determined. Spectral and time characteristics are given for the fundamental frequency radiation and for the second harmonic emitted by the YAG laser. (5 refs.)

118220 Synthesis of the D_2O laser frequency ($\lambda=84\ \mu$) using a superconducting nonlinear device. N.G.Basov, E.M.Belenov, S.I.Vedeneev, M.A.Gubin, K.N.Glazachev, V.V.Nikitin, V.A.Stepanov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.339-43 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR),* vol.10, no.3, p.574-9 (March 1983). [received: Oct. 1983]
Experiments are described on multiplying the frequency (7.4×10^{10} Hz) of a klystron and mixing the multiplied frequency with radiation of frequency 3.6×10^{12} Hz from a D_2O laser. The nonlinearity of superconducting point contacts and the experimental method employed made it possible to multiply and mix at frequencies exceeding several times the ultimate frequency, and to investigate the mixing mechanism. The amplitude of the beat signal between the laser radiation and the multiplied klystron frequency was proportional to the differential resistance of the contact. Over a wide range of contact bias voltages, the frequency on the beat signal was independent of the Josephson emission frequency. No substantial difference was discovered between the nonlinear properties of the contacts at frequencies of 10^{10} and 3.6×10^{12} Hz. It was found that superconducting point contacts enabled a considerable simplification to be made in the frequency synthesis chain of an He-Ne laser by excluding several klystrons, metal-oxide-metal diodes, and a bulky submillimeter HCN laser. (8 refs.)

118221 Energy characteristics of stimulated scattering of ultrashort light pulses. G.L.Brekhovskikh, A.I.Sokolovskaya (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR), J.Ferrier, Z.Wu, G.Rivoire.
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.372-4 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR),* vol.10, no.3, p.622-4 (March 1983). [received: Oct. 1983]
An investigation was made of the energy characteristics of stimulated Raman scattering (STRS) and of stimulated scattering in the Rayleigh wing (STSRW) of YAG laser pulses of 25 psec duration in benzene, carbon disulfide, and toluene. It was established that when the active-layer thickness was of the order of the spatial length of the laser pulses, the forward and backward STRS and STSRW processes were in the form of an amplified spontaneous noise of intensity which varied stochastically from one shot to another. The STRS and STSRW threshold were governed by the relaxation times of the molecules in the active medium. When the thickness of the scattering layer was much greater than the spatial length of the laser pulses, the nature of the energy dependence of the forward STRS approached the energy dependence of the STRS excited by pulses of nanosecond duration. (15 refs.)

118222 Efficient conversion of visible radiation from a tunable dye laser to the ultraviolet range. S.M.Kopylov, L.K.Mikhailov, O.B.Cherednichenko.
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.375-6 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR),* vol.10, no.3, p.625-7 (March 1983). [received: Oct. 1983]
An experimental investigation was made of the conversion of the second harmonic of the radiation of a dye laser of wavelengths 545-760 nm into ultraviolet radiation of wavelengths 217-280 nm by the method of sum-frequency generation. The use of a KDP crystal with phase matching by angular adjustment ensured that the conversion efficiency was 35%. (9 refs.)

118223 Generation of tunable infrared radiation by stimulated Raman scattering on hydrogen in a prism-lens optical delay line. R.B.Andreev, V.S.Butylkin, V.A.Evtyushkin, P.S.Fisher, V.V.Khabarov (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.406-8 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR),* vol.10, no.3, p.662-4 (March 1983). [received: Oct. 1983]
The threshold of stimulated Raman scattering was lowered by filling an optical delay line with hydrogen. Pumping was by a tunable neodymium laser. Lens-prism combinations were used as phase correctors in the delay line. The dependences of the energy of the Stokes component on the pump energy determined experimentally for different numbers of transitions through the delay line were compared with the results of a calculation allowing for the losses in the components of this line. When the frequency conversion was by a factor of at least 2 and the tuning range was wide (tens of percent), the optimal performance was obtained from the optical delay line when total-internal-reflection prisms and lenses were combined in a single component and oriented at the Brewster angle. (4 refs.)

118224 Efficient up-conversion of a CO_2 laser frequency in sodium vapor. N.P.Makarov, A.K.Popov, V.P.Timofeev (L.V. Kirenski Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.408-9 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR),* vol.10, no.3, p.664-5 (March 1983). [received: Oct. 1983]
A quantum efficiency of 65% (corresponding to a power efficiency of 2640%) was achieved in up-conversion of $\lambda=10.8\ \mu$ CO_2 laser radiation by resonant parametric mixing in sodium vapor. (1 ref.)

118225 Possibility of using the method of coherent anti-Stokes scattering under stimulated Brillouin backscattering conditions. A.F.Bunkin, D.V.Vlasov, R.A.Garaev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.412-13 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR),* vol.10, no.3, p.669-70 (March 1983). [received: Oct. 1983]
An analysis is made of variants of systems which can extend the range of conditions under which the CARS method can be used. An analysis is made of the efficiency of such systems from the point of view of the condition for spatial phase-matching in four-wave interactions. (2 refs.)

Anti-Stokes Raman laser emission at 149 nm in atomic bromine ....See Entry 118127

Low-threshold semiconductor Raman laser ....See Entry 118151

Pulsed-pump tunable lasers ....See Entry 118158

Phase matching and frequency detuning effects in Brillouin enhanced four-wave mixing ....See Entry 118227

Second-harmonic emission from laser-plasma interactions .....See Entry 118730

Pulsed-laser annealing of GaAs surface studied by time-resolved second-harmonic generation in reflection ....See Entry 119062

42.65F Phase conjugation

118226 Wavefront inversion and the problem of shaping the structure of laser radiation. V.I.Bespalov, G.A.Pasmanik (Inst. of Appl. Phys., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.17-26 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.,* vol.44, no.8, p.1572-84 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
Monochromatic radiation of arbitrary structure and polarisation can, in principle, be exactly 'inverted'—sent back along the same path—and exactly duplicate the original ('direct') radiation as it propagates in a nonmoving medium The situation is different if the spatial structure of the radiation varies in time. In this case, the surface of the wavefront is also changed and, consequently, the shape and position of the reflecting surface must be changed. Because of the Doppler effect associated with the latter's motion, the frequency of the inverted radiation will differ from that of the incident radiation and, consequently, inversion will not be exact. For nonstationary radiation the choice of the manner in which the inverting surface moves is, generally speaking, nonunique as well. Only supplementary conditions involving minimization of the various distortions can reduce this ambiguity. The magnitude and nature of the frequency change on inversion may be determined by the type of inverting device used. The authors investigate how the shape of the inverting surface may be determined. (33 refs.)

118227 Phase matching and frequency detuning effects in Brillouin enhanced four-wave mixing. A.M.Scott (Royal Signals & Radar Establ., Malvern, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.276-83 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The theory of phase conjugation by Brillouin enhanced 4 wave mixing is developed and the effects of phase mismatching and detuning the probe beam from the centre of the Brillouin resonance are investigated. Extremely high reflection coefficients ($R>10^6$) are shown to be possible when one jump beam is much stronger than the second, and when the pump beam intensities, the probe beam frequency and the interaction length all take certain critical values. (5 refs.)

118228 Highly efficient, high-quality phase-conjugate reflection at 308 nm using stimulated Brillouin scattering. E.Armandillo (ENEA-CRE, Rome, Italy), D.Proch.
Opt. Lett. (USA), vol.8, no.10, p.523-5 (Oct. 1983).
The authors report efficient, diffraction-limited phase conjugation of a XeCl laser beam (308 nm) using stimulated Brillouin scattering. Reflectivities approaching 100% are obtained by focusing a XeCl laser ($<0.15\ cm^{-1}$ linewidth) at 300 GW/cm^2 into heptane or ethanol. (7 refs.)

Present status of holographic laser beam dynamic correction methods ....See Entry 118094

42.65G Photon echoes, self-induced transparency, optical saturation and related effects

118229 Stochastic theory of emission spectrum from strongly driven system. E.Hanamura (Dept. of Appl. Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3265-74 (Sept. 1983).
The effect of frequency modulation on optical phenomena is reduced critically when the Rabi frequency increases beyond the inverse correlation time or the amplitude of the frequency modulation. This is observed in the time region as the change of the free induction decay rate from the Bloch type into the Redfield one. This is shown to be observable also in the frequency region as the narrowing of the central line and the side bands split-off by the Rabi frequency above and below it in the emission spectrum beyond the case when the Rabi frequency is equal to the inverse correlation time.

118230 Oscillatory behaviour of two-photon echo signals. R.Boscaino, F.M.Gelardi, G.Messina (Istituto di Fisica, Palermo, Italy).
Phys. Lett. A (Netherlands), vol.97A, no.9, p.413-16 (26 Sept. 1983).
The two-photon (TP) echo effect has been investigated in a two-level spin system (E'_1 centres in glassy silica) by revealing the second-harmonic wave emitted by the system. Oscillatory signals were observed when either of the input pulses was long compared to the TP-nutational period. (18 refs.)

118231 Self-induced transparency in limited media. G.T.Adamashvili (Tbilisi State Univ., Tbilisi, USSR), S.V.Manakov.
Solid State Commun. (USA), vol.48, no.4, p.381-4 (Oct. 1983).
A theory is constructed of self-induced transparency for a surface wave propagating on the boundary surface of two media, one of which is a resonance one, and also for a localized TE-mode in dielectric waveguide, containing non-intersecting two-level atoms. An evident expression is found for a pulsing solition, formed in these conditions, in terms of initial data. (6 refs.)

Collisional relaxation of backward photon echo in molecular sodium ....See Entry 117959

Photochemical time-domain holography of weak picosecond pulses ....See Entry 118103

Exponent behaviors of single mode laser system with saturable absorber near threshold ....See Entry 118110

Controlling the length of ultrashort light pulses from a Q-switched ruby laser ....See Entry 118179

A new approach to the generation of high-power nanosecond pulses in CO_2 lasers ....See Entry 118180

Observation of intensity fluctuations and mode correlations in a broadband CW dye laser ....See Entry 118189

The polariton soliton formation due to the effect of the dipole momentum saturation ....See Entry 119469

Picosecond photoinduced optical anisotropy in trans-$(CH)_x$: direct measurement of soliton diffusion ....See Entry 120018

42.65J Beam trapping, self focusing, thermal blooming, and related effects

118232 Control of laser beams in nonlinear media. Problems of suppressing nonlinear distortions. M.A.Vorontsov, V.P.Kandidov, A.P.Sukhorukov, S.S.Chesnokov (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.55-62 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1622-30 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
Methods for optimization of the propagation of light beams in nonlinear media are discussed. Computer modelling is used to analyze the effectiveness of the algorithm proposed for optimum control of the amplitude-phase profile of the beam to suppress thermal self-action in a moving medium. (17 refs.)

118233 Interaction between light beams in thermocapillary liquid media. G.da Costa, F.Bentolila, E.Ruiz, H.Galan (Dept. de Phys., Univ. Simon-Bolivar, Caracas, Venezuela).
J. Opt. (France), vol.14, no.4, p.179-88 (July-Aug. 1983). In French.
The free surface of a thermocapillary liquid is heated by irradiation with a Gaussian laser beam. The free surface passes by an earlier dilatation stage, followed by the formation of a pit. The surface deformation modulates in turn the phase of the reflected and transmitted beams. This phenomenon belongs to the domain of self-modulation of light beams by interaction with a material medium. The dynamics of formation of a complex depression is studied experimentally and numerically. (12 refs.)

118234 The orientational optical nonlinearity of planarly aligned long-pitch cholesterics. N.F.Pilipetsky, A.V.Sukhov, B.Ya.Zel'dovich (Inst. for Problems in Mech., Moscow, USSR).
Mol. Cryst. & Liq. Cryst. Lett. (GB), vol.92, no.6, p.157-63 (1983).
Optical nonlinearity of self-focusing type is investigated both theoretically and experimentally, which is due to reorientation of the cholesteric director by the light field, the effective nonlinear susceptibility decreasing abruptly with the shortening of the pitch P. (5 refs.)

118235 Breakup of beams with a regular spatial structure in a cubic medium. L.A.Bol'shov, D.V.Vlasov, R.A.Garaev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.365-8 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.613-16 (March 1983). [received: Oct. 1983]
Experimental and theoretical studies were made of the characteristics of an instability of beams with regular spatial spectra in the presence of small-scale self-focusing. The process differed qualitatively from small-scale self-focusing of a plane wave and the difference was due to the possibility of simultaneous growth of perturbations, of various spatial spectral components in the field of several pump components in the case of spatial phase matching between the interacting waves. The growth increments of the instabilities were calculated for different types of spatial spectra of pump beams. (10 refs.)

42.70 OPTICAL MATERIALS

118236 Optical materials for CO_2 lasers. N.V.Karlov, E.V.Sisakyan (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.63-8 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1631-8 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
The basic characteristics of certain optical materials for use in CO_2 lasers, e.g. the absorption coefficients at $\lambda=10.6$ microns, continuous-duty optical strength, and pulsed-operation radiative strength, are discussed. (5 refs.)

118237 TeO_x thin films for an optical disc memory. M.Takenaga, N.Yamada, K.Nishiuchi, N.Akahira, T.Ohta, S.Nakamura, T.Yamashita (Central Res. Lab., Matsushita Electrical Industrial Co. Ltd., Osaka, Japan).
J. Appl. Phys. (USA), vol.54, no.9, p.5376-80 (Sept. 1983).
Tellurium suboxide thin films TeO_x were found to change in refractive index and extinction coefficient on thermal or optical heating, with accompanying changes in the reflectivity and transmission. The preparation method and thermal or optical properties of the TeO_x thin films were investigated to obtain a stable and highly sensitive optical disc memory. A two-source evaporation method using Te and TeO_2 provided a uniform and any desired composition. The properties of the film depended on the x value; increasing x to as large as $x=1.2$, which represents a Te-poor composition, produced an excellent humidity and heat stability, and decreasing x to 0.8 made the film more sensitive to a laser diode, but susceptible to humidity. The $TeO_{1.1}$ thin film was found to sufficiently satisfy all requirements for practical disc applications. A reflective optical disc was prepared using the $TeO_{1.1}$ thin film deposited on a polymethylmethacrylate substrate with grooves for optical tracking. This disc is capable of recording video signals at real time by laser diodes. It showed no reflectivity changes on recorded or unrecorded areas and no sensitivity change to laser light after long term storage in high humidity and temperature. (9 refs.)

A highly precise and highly sensitive instrument for measuring optical retardation of birefringence .... See Entry 117223

Materials for quantum electronics (yttrium-aluminum garnet, lithium niobate) .... See Entry 118149

Window and mirror materials for use at 10.6 micron .... See Entry 118184

Effects of multiple interaction in laser damage to optical materials .... See Entry 118192

Ion-implanted waveguides .... See Entry 118273

Radiation-optical properties of quartz glass fiber-optic waveguides (review) .... See Entry 118293

Quality of ADP crystals formed by rapid growth from a point-like seed .... See Entry 120235

Growth and investigation of $Ca_3(VO_4)_2$ .... See Entry 120237

42.70C Glass

118238 Effect of thermal stress on the homogeneity of optical glasses. Zhao Weng-xing, Wang Da-heng (Changchun Inst. of Optics & Fine Mech., Acad. Sinica, Changchung, China).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.134-9 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
When glass is annealed under stressed conditions, its physical properties such as refractive index, density, etc., are subjected to change as compared with similarly annealed glass under stress free conditions. This phenomenon may be termed 'thermal stress effect'. Various types of optical glasses were studied for this effect by an interferometric method using beam shaped specimens annealed under external bending conditions. In the annealing of a bulk of optical glass, when cooling the glass through the annealing range, thermal stress is generated within the bulk of glass, resulting in an uneven distribution of refractive index due to the thermal stress effect. Experiments were carried out for various types of optical glasses and their corresponding values were evaluated. (6 refs.)

Ion-implanted waveguides .... See Entry 118273

The promise of the future [low-loss optical fibres] .... See Entry 118279

Radiation-optical properties of quartz glass fiber-optic waveguides (review) .... See Entry 118293

The complexes of platinum, their optical properties and their changes in optical glasses .... See Entry 120148

42.70G Light-sensitive materials

Some characteristics of and measurements on dichromated gelatin reflection holograms .... See Entry 118101

42.72 OPTICAL SOURCES AND STANDARDS

(for spectroscopic light sources, see also 07.65)

118239 Partially polarized planar sources that generate the same intensity distribution at the output plane. R.Martinez-Herrero (Dept. de Optica, Facultad de Ciencias Fisicas, Univ. Complutense, Madrid, Spain), P.M.Mejias.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.570-3 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
For general non-dispersive optical systems, the existence of quasimonochromatic planar sources with different states of partial polarization that generate identical intensity distributions at the output plane of the system has been investigated. By using the procedure outlined by the authors in previously reported works, the common characteristic and the relationship that must be satisfied by the coherence matrix of all these sources have been determined. (12 refs.)

118240 Characteristics of K-Rb lamps as the pump sources for $YAG:Nd^{3+}$ lasers. E.N.Gaidukov, P.I.Gerashchenko, P.G.Konvisar, V.A.Kuznetsov, G.S.Leonov, S.R.Rustamov.
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.368-9 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.616-18 (March 1983). [received: Oct. 1983]
An experimental investigation was made of some characteristics of the operation of Soviet K-Rb pump lamps designed for $YAG:Nd^{3+}$ lasers. It was found that at low pumping rates these K-Rb lamps are efficient pump sources for $YAG:Nd^{3+}$ lasers. (3 refs.)

Source encoding, signal sampling and spectral band filtering for partially coherent optical signal processing .... See Entry 118088

Future technological applications of rare-earth-doped materials .... See Entry 120755

42.78 OPTICAL LENS AND MIRROR SYSTEMS

(for microscopes, see 07.60P; for photographic instruments, see 07.68; for astronomical telescopes, see 95.55)

118241 Effects of a magnetic field on the optical properties of dielectric mirrors. E.Iacopini, G.Stefanini, E.Zavattini (CERN, Geneva, Switzerland).
Appl. Phys. A (Germany), vol.A32, no.2, p.63-7 (Oct. 1983).
The authors have measured the changes in the polarization state of a monochromatic ($\lambda=514.5$ nm) light beam on reflection at normal incidence by a multilayer dielectric mirror placed in a time-modulated magnetic field. The dominant effect is a Faraday rotation $\Phi\simeq3.7\times10^{-10}$ rad/G. The sensitivity (around 40 Hz) obtained is $\simeq6\times10^{-9}$ rad/$\sqrt{}$Hz, which is dominated by the shot-noise limit (100 mW of light power). (7 refs.)

118242 Simple quasi-zoom with stable pupils. T.H.Jamieson, W.H.Taylor (Kollmorgen Corp., Northampton, MA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.58-63 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
In conventional zoom systems with the aperture stop located to the rear of the moving components, the entrance pupil position varies greatly during zooming. A simple system of three positive elements, is described which can be used as a dual focal length quasi-zoom lens, which for a rear-positioned aperture stop, has a constant entrance pupil at the zoom extremes. The system may also be employed as a true zoom with limited excursion of the entrance pupil between the zoom extremes. The system is useful as a zoom relay stage in a periscope or where a prism or mirror is located at the entrance pupil to scan the line of sight. (1 ref.)

118243 Compact infrared continuous zoom telescope. M.Roberts, D.R.J.Campbell (Pilkington P.E. Ltd., St. Asaph, Clwyd, Wales).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.64-76 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
In the field of infrared optics (8-12 microns) there is an increasing requirement for continuous zoom telescopes operating with scanner systems. To date, zoom telescopes have for some applications been precluded due to excessive length. An exercise was undertaken to explore the possibility of length reduction. The study resulted in the design of a compact, high performance IR zoom telescope. This design and its development are described including achromatisation, athermalisation and tolerancing aspects. (5 refs.)

118244 Elect-equimultiple imaging with stacked distributed-index planar microlenses. M.Oikawa, K.Iga, M.Morinaga (Res. Lab. of Precision Machinery & Electronics, Tokyo Inst. of Technol., Yokohama, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L386-88 (July 1983).
Four pieces of 2-D arrays of distributed-index planar microlenses (0.8 mmϕ and $f=2$ mm) have been stacked to construct an imaging component. Its working distance was 20 mm and clear images with resolution of more than 20 line pairs/mm have been obtained. (10 refs.)

118245 The Mangin mirror as imaging element. M.J.Riedl (Infrared Industries, Santa Barbara, CA, USA).
Electro-Opt. (USA), vol.15, no.6, p.50-4 (June 1983).
Mangin mirrors conveniently minimize the need for aspherizing reflective elements in infrared detection systems. It is basically a negative meniscus lens

with reflecting second surface. The curvature of the first of the two spherical surfaces is chosen to correct the spherical aberration of the reflector. By this method, the costly manufacturing process of aspherizing a reflective surface can be avoided. Unfortunately, calculating the required radii even for the easiest of all cases—the object at infinity—leads to quite cumbersome mathematical expressions. The particular approximation method uses an iteration process to change the shape of the Mangin mirror in steps until the set limit for acceptable (or desirable) spherical aberration has been met. This technique is based on the typical third-order thin-lens aberration formalism. (3 refs.)

118246 Portable projectors for 16 mm film in 50-year history of the firm Meopta. L.Kuceta.
Jemna Mech. & Opt. (Czechoslovakia), vol.28, no.6, p.166-8 (June 1983). In Czech.
E.D.

118247 Cinematography automation. I.Mateju.
Jemna Mech. & Opt. (Czechoslovakia), vol.28, no.6, p.169-71 (June 1983). In Czech.
Development of automated 35 mm projectors in Czechoslovakia is discussed and the main features of the Meo 5X automatic projector are outlined. (no refs.) *E.D.*

118248 Utilisation of electronics in optical-mechanical instruments. J.Teska.
Jemna Mech. & Opt. (Czechoslovakia), vol.28, no.6, p.172-4 (June 1983). In Czech.
Several examples of innovations of 16 mm projectors, auxiliary equipment of manufacturing apparatus and 35 mm projectors developed by the ZVS-Meopta, Prerov, are discussed which are based on the implementation of electronic circuits. Experiences with the applications of the 8080 microprocessor to a microfiche reader are also discussed. (no refs.) *E.D.*

118249 New generation lens systems for the Wild aviophot aerial camera system. K.Hildebrand (Optical Design Dept., Wild Heerbrugg Ltd., Heerbrugg, Switzerland).
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.8, p.1201-9 (Aug. 1983).
Reports on some of the criteria which have to be met in the further development of aerial-camera lens systems. The quality criteria that were constantly observed in the development work are described in detail, among which integrals on the MTF and their area-weighted average proved particularly useful. Details are given of the metric characteristics and of the image quality of the new lens systems in the visible and near infrared range, and these are compared with the comparable performance data of the older lens types. It is demonstrated that the lens systems of this new generation have a substantially greater information-transmission capacity, a more homogeneous image quality, and lower residual distortion. (6 refs.)

Optical encrypting system .... See Entry 118087
Effect of figure and waviness on image quality .... See Entry 118089
Multifocal holographic optical components .... See Entry 118100
Continuously coupled unstable resonators: problem of large output beam divergence .... See Entry 118169
Review of laser induced damage thresholds .... See Entry 118182
Window and mirror materials for use at 10.6 micron .... See Entry 118184
Generation of tunable infrared radiation by stimulated Raman scattering on hydrogen in a prism-lens optical delay line .... See Entry 118223
Collimator with simulated eye aberrations for use in measuring the modulation transfer function (MTF) of telescopes and binoculars .... See Entry 118250
Chirped grating lenses in Ti-indiffused $LiNbO_3$ optical waveguides .... See Entry 118304
Integrated optical microwave spectrum analyser (IOSA) using geodesic lenses .... See Entry 118305
Diamond machining. The impact on rotating scanners .... See Entry 118308
The theory and apparatus of laser interferometric centring ... See Entry 118314
25-M optical telescope with a mosaic main mirror .... See Entry 121529
Possible optical design of a telescope with a spherical main mirror 20-24 m in diameter .... See Entry 121530
examination of concave and convex aspherical mirrors with a T-shaped spherometer .... See Entry 121531
Computation of the profile of a surface accurately corrected for spherical aberration on the axis in a centered optical system .... See Entry 121538

42.78H Coatings

Synthesis of optical films during oblique incidence of light ... See Entry 118074
Quantitative measurement of energy deposited in optical coatings .... See Entry 118183
Deposition of new reflecting layers on mirrors during extra-atmospheric experiments .... See Entry 121532

42.80 OPTICAL DEVICES, TECHNIQUES AND APPLICATIONS

(for optical instruments and techniques, see 07.60; for optical spectroscopy, see 07.65; for photography, see 07.68; for holography, see 42.40; for lasers, see 42.55 and 42.60; for masers, see 42.52)

118250 Collimator with simulated eye aberrations for use in measuring the modulation transfer function (MTF) of telescopes and binoculars. T.L.Williams, M.L.Nunn (Sira Ltd., Chislehurst, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.78-83 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A collimator is described which has residual chromatic and spherical aberration similar in magnitude to that of the human eye. The collimator can be used in experimental measurements of the MTF of telescopes and binoculars in order to assess the overall performance of eye plus instrument. The collimator can also be used as the basis for theoretical studies of the effect of eye aberrations on the performance of visual instruments. Examples are given of the effect which the optics of the eye can produce on the MTF of a well corrected telescope. The authors also consider some of the predictions about the visual system which can be made from a study of the through-focus MTF curves of the collimator, such as the magnitude of night myopia. (4 refs.)

118251 Single material achromatic half-wave plate design. N.W.F.Stephens (Spectron Optical Holdings Ltd., Abingdon, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.322-6 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A simple effective achromatic half wave plate has been designed by computer analysis of birefringent networks based on Poincare sphere representation. By observing some simple rules and applying selection criteria based on rotational properties of half wave plates, some potentially successful plate configurations have been identified. The most promising of these, a three plate combination, has been chosen for manufacture and is now available from the Spectron product range. (4 refs.)

118252 Evolution of map display optical systems. A.Boot (Navigation Systems Dept., Ferranti plc, Edinburgh, Scotland).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.512-20 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Traces the development of Ferranti plc optically projected map displays from the early V Bomber and the ill-fated TSR2 displays to the Harrier and Concorde displays. The author then goes on to the development of combined map and electronic displays (COMED), showing how an earlier design, as fitted to Tornado, has been developed into the current COMED design which is fitted to the F-18 and Jaguar aircraft. In each of the above display systems particular features of optical design interest are identified and their impact on the design as a whole are discussed. The use of prisms both for optical rotation and translation, techniques for the maximisation of luminance, the problems associated with contrast enhancement, particularly with polarising filters in the presence of optically active materials, the use of aerial image combining systems and the impact of the pilot interface on the system parameter are all included. Perhaps the most interesting result in considering the evolution of map displays has not been so much the designer's solutions in overcoming the various design problems but that both the pilot and his environment are themselves an integral part of the system optical design. (no refs.)

118253 Diffracting optics. M.C.Hutley (NPL, Teddington, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.643-6 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Optical elements which direct light by diffraction rather than by reflection have hitherto been very little used because of their chromatic aberration and low efficiency. However, with the more widespread use of lasers there is an increasing number of applications for which chromatic aberration is no longer a problem. With a thick hologram or a blazed surface relief pattern it is possible to achieve useful efficiencies so it now seems reasonable to expect a wider use of diffracting optics. Using holographic techniques it is feasible to produce components of excellent optical quality which are both cheaper and lighter than their conventional counterparts. (3 refs.)

118254 A fast electro-optic focusing device. S.Sullivan (Lincoln Laser, Phoenix, AZ, USA).
Opt. & Laser Technol. (GB), vol.15, no.5, p.249-52 (Oct. 1983).
A dynamic focus method is described which enables the instantaneous focus to be changed dynamically to give an optimum focus for the object illuminated by the laser beam. The dynamic focus method employed uses a three-stage electrooptic focusing device. Each stage of the device consists of an electrooptic cell and a birefringent lens. Performance results are presented for a two state focusing device which demonstrates the feasibility of the system. The switching rate is 158 kHz and the rise-time of the cell is 40 ns. (no refs.)

SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82 .... See Entry 116913
Optical Sensing Techniques, Benefits, Costs .... See Entry 116915
Optical sensing and engineering metrology .... See Entry 117207
Measurement of coherence of radiation from diffusely illuminated beam splitters .... See Entry 118070
Synthesis of optical films during oblique incidence of light ... See Entry 118074
Generation of tunable infrared radiation by stimulated Raman scattering on hydrogen in a prism-lens optical delay line .... See Entry 118223
Integrated-optics elements and systems .... See Entry 118303

42.80B Spatial filters, zone plates

118255 Applications of interference coatings in optical processing. G.Molesini, D.Bertani, M.Cetica, F.Quercioli (Istituto Nationale di Ottica, Firenze, Italy).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.130-3 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The optical transfer function of interference coatings in quasi-monochromatic light appears suitable to directly perform 2-D low-pass, band-pass and high-pass spatial frequency filtering. Uniformity of the coating over an extended area allows for space-invariant operation. Both coherent and incoherent processing are possible. In multiple wavelength frequency bands. This allows for parallel imaging in multiple wavelength with different transfer functions, and can result for pseudocolouring effects if suitable coating such as unblocked interference filters are employed. (13 refs.)

118256 CGH filters for coding and decoding dilute objects. Xie Ching-hui, Cheng Hui-ling, Wu Min-shian, Chin Kuo-fan (Dept. of Precision Instruments, Tsing Hua Univ., Beijing, China).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.510-11 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Describes the formation of an arbitrary blurring followed by the use of a filter in a frequency plane to eliminate the blur. The complex space filters produced by the computer-generated method enables one to construct many new and fascinating coding and decoding systems for dilute objects. Several CGH filters, inverse filters, Wiener filters and the Wiener filter of the exponential type, have been developed. All these filters have been experimentally tested as to their capabilities for cryptology and good results have been obtained. (4 refs.)

Character recognition: a new multiple filter .... See Entry 118092
Some characteristics of and measurements on dichromated gelatin reflection holograms .... See Entry 118101
Construction of a two-dimensional colour hologram using a source encoding technique .... See Entry 118104

42.80C Spectral and other filters

118257 Acoustooptical tunable filters. L.N.Magdich (Moscow Inst. of Radioengng. Electronics & Automation, Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.103-9 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1683-90 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
Outlines the operating principle of the acoustooptical filter (AOF). Relationships are introduced for the tuning curve, apparatus function, and response speed. Various types of AOF are discussed and their parameters are compared. Acoustooptical materials used for AOF are discussed. The directions in which AOF will be improved are predicted and possible fields of application of the filters are listed. (14 refs.)

118258 Synthesised design of optical filters assisted by microcomputer. J.S.Seeley (Dept. of Cybernetics, Univ. of Reading, Reading, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.118-29 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
New algorithms and microcomputer-programs for generating original multilayer designs (and printing a spectral graph) from refractive-index input are presented. The programs are characterised TSHEBYSHEV, HERPIN, MULTILAYER-SPECTRUM and have originated new designs of narrow-stopband, non-polarising edge, and Tshebyshev optical filter. Computation procedure is an exact synthesis (so far as this is possible) numerical refinement not having been needed. (20 refs.)

118259 Tunable bandstop filter for binary objects: a self-imaging technique. J.Ojeda-Castaneda, E.E.Sicre (Phys. Inst., Univ. Erlangen-Nurnberg, Erlangen, Germany).
Opt. Commun. (Netherlands), vol.47, no.3, p.183-6 (1 Sept. 1983).
Negative Talbot images are employed to obtain a simple tunable, bandstop filter for binary objects, that are composed of pieces with Ronchi rulings (Rademacher functions). (12 refs.)

Frequency plane filtering in a microscope .... See Entry 117225

Intelligent attenuator for laser pulse energy and power stabilization .... See Entry 118172

42.80D Monochromators

118260 Monochromator with a plane focusing diffraction grating. Z.Mateeva (Central Lab. of Optical Storage & Processing of Information, Bulgarian Acad. of Sci., Sofia, Bulgaria).
J. Opt. (France), vol.14, no.4, p.209-12 (July-Aug. 1983).
An optical system of a monochromator with a focusing holographic grating on a plane substrate is proposed. The procedure for the optimization of its design is described. The performance and the quality of the monochromator are evaluated and the results are illustrated by spot-diagrams. (6 refs.)

Crystals for synchrotron radiation experiments .... See Entry 117293

42.80E Shutters, windows, diaphragms, deflectors, choppers

118261 Multiwavelength operation of an acoustooptic deflector. R.A.Edwards, S.Sullivan (Rediffusion Simulation Ltd., Crawley, England), R.W.Smith.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.655-61 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
An acousto-optic deflector is essentially a diffractive device, and hence the scan generated by the deflector is a function of the optical wavelength used. This has meant that for multiwavelength operation, such as colour laser displays, separate deflectors have been used for each wavelength. The extension of their use, to include more than one wavelength, would clearly have a number of practical advantages. The authors describe a novel holographic method which allows the deflector to be used with more than one wavelength. Also reported is an assessment of the practicality of the method. (no refs.)

Dynamic phase hologram for laser beam steering .... See Entry 118102

Review of laser induced damage thresholds .... See Entry 118182

Window and mirror materials for use at 10.6 micron .... See Entry 118184

Opto-optical light deflection .... See Entry 118197

Fast beam deflectors based on phase matching .... See Entry 118207

Optical sensor with fibre optic links: a shutter modulator .... See Entry 118264

42.80F Gratings, echelles

118262 Calibrated grating attenuator. C.Castellini, G.Molesini (Istituto Nazionale di Ottica, Firenze, Italy).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.178-9 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A calibrated attenuator is demonstrated, operating on a well-known power distribution produced by diffraction. The diffraction object is a Ronchi ruling. Once its physical characteristics are known, the angular power spectrum provides a set of mutually calibrated sources over an extended intensity range. Precise measurements of the grating performance in the visible are referred, and scaling to NIR is demonstrated with generation of a number of calibrated sources. In pulse laser operation the method is proved suitable to obtain a reliable rationing to compute the peak value of the pulses, and to sample fixed attenuations. (no refs.)

118263 New methods for ruling long diffraction gratings. Liang Haoming, Hao De-fu (Changchun Inst. of Optics & Fine Mech., Chinese Acad. of Sci., China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.199-208
Diffraction gratings are the indispensable components for various kinds of spectrometers. Due to the limiting conditions imposed by the ordinary ruling machine, long diffraction gratings are very difficult to make. Two methods for ruling long diffraction gratings which overcome these are presented: the 'step-guiding method' and the 'self-guiding method'. The first method makes use of an intermittent interferometer controlled ruling machine, the second method makes use of a continuous photo-electric controlled ruling machine. (2 refs.)

Precision displacement measurement using a diffraction grating .... See Entry 117149

New grating spectrometer with increased throughput .... See Entry 117245

A new method of grating spectroscopy .... See Entry 117246

Detection of hidden diffractors by coherence measurements .... See Entry 118069

Dynamic phase hologram for laser beam steering .... See Entry 118102

Opto-optical light deflection .... See Entry 118197

Diffracting optics .... See Entry 118253

Monochromator with a plane focusing diffraction grating .... See Entry 118260

Optical sensor with fibre optic links: a shutter modulator .... See Entry 118264

Chirped grating lenses in Ti-indiffused $LiNbO_3$ optical waveguides .... See Entry 118304

Micro-optical 3-dB mode converters .... See Entry 118306

Self-guiding method for ruling diffraction gratings .... See Entry 118309

Ion beam etching in InP. I. Ar ion beam etching and fabrication of grating for integrated optics .... See Entry 118310

Embossing technique for fabricating integrated optical components in hard inorganic waveguiding materials .... See Entry 118312

42.80K Optical beam modulators

118264 Optical sensor with fibre optic links: a shutter modulator. B.E.Jones, R.C.Spooncer (Dept. of Instrumentation & Analytical Sci., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.376, p.29-36 (1983). (Optical Sensing Techniques, Benefits, Costs, Teddington, Middx., England, 7-8 Dec. 1982).
Describes a simple passive optical displacement sensor which uses the relative movement of a pair of parallel gratings to modulate infrared light coupled between the ends of two optical fibres and has a linear output-displacement relationship. Results are reported for a series of gratings of different pitch. (13 refs.)

118265 Optical tuning of a tellurium cavity—optical modulation and determination of semiconductor parameters. G.Staupendahl, K.Schindler (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.159-70 (1983). In English.
A new optical-optical modulator for the infrared region ($4\ \mu m < \lambda < 11 \mu m$) is described. It is based on the tuning of the transmission of a plane parallel tellurium slab by free carriers created by multiphoton absorption of 10.6 μm and 5.3 μm radiation at room temperature. The operation of this device is described by a simple theory using the plane-wave approximation and the Drude-Zehner model. The assumptions of this theory were fulfilled by the experimental conditions, permitting a quantitative analysis of the registered modulations. Under certain working conditions pulse shortening (170 ns pulses of $\lambda = 5.3\ \mu m$ were shortened by up to 20 ns) and fast switch-on of the device (switch-on time $\leq$2ns) were observed. Moreover, the modulator exhibits limiter action and optical bistability, which, for the first time, is observed in an intrinsic semiconductor device at room temperature. (9 refs.)

Dynamic optical cross-correlator using a liquid crystal light valve for real time data input .... See Entry 118096

Design of a pulse stacker .... See Entry 118170

Laser pulse shaping with liquid crystals .... See Entry 118171

Intelligent attenuator for laser pulse energy and power stabilization .... See Entry 118172

Rare earth Faraday rotator materials for lasers .... See Entry 118175

Ultrashort optical pulse generation from microwave modulated AlGaAs diode laser with Selfoc rod resonator .... See Entry 118178

Opto-optical light deflection .... See Entry 118197

Calibrated grating attenuator .... See Entry 118262

Single mode laser spectral spread repercussion in single-mode optical fiber coherent detection systems .... See Entry 118277

Micro-optical 3-dB mode converters .... See Entry 118306

42.80L Optical waveguides

(for fibre optical waveguides, see 42.80M)

118266 An array of optical stripe wave guides. M.D.Makhdoom (Dept. of Electrical & Electronic Engng., Mehran Univ. of Engng. & Technol., Jamshoro, Pakistan).
Mehran Univ. Res. J. Eng. & Technol. (Pakistan), vol.2, no.1, p.21-5 (Jan. 1983). [received: Sept. 1983]
Discusses the experimental details of an array optical stripe wave guide including the attenuation and resolution of the device. Experimental measurements were made and the results are presented. The viability of the device and possible future work are also discussed. (5 refs.)

118267 Crosstalk characteristics of lens-like Ti-$LiNbO_3$ intersecting channel waveguides. C.T.Lee (Chung Shan Inst. of Sci. & Technol., Lung-Tan, Taiwan).
Electron. Lett. (GB), vol.19, no.20, p.805-6 (29 Sept. 1983).
Crosstalk characteristics of intersecting channel waveguides are presented. Full diffusion times of various Ti film thicknesses are measured first. The concentration distributions in Ti-$LiNbO_3$ crosschannel waveguides are then calculated and compared with the measured distribution. The lens-like medium is the crossover region of crosstalk between Δn and $2\Delta n$ crosschannel waveguide. (6 refs.)

118268 Accurate analysis of the abrupt discontinuity in a dielectric waveguide. T.Takenaka, O.Fukumitsu (Dept. of Computer Sci. & Communication Engng., Kyushu Univ., Fukuoka, Japan).
Electron. Lett. (GB), vol.19, no.20, p.806-8 (29 Sept. 1983).
An accurate analysis of the step discontinuity in a dielectric waveguide is presented. The analysis incorporates the iterative procedure into Lewin's approximate analysis of the laser emission extending Hockam's idea (1974). The numerical solution of the problem converges very quickly. (5 refs.)

118269 Matrix method for determining propagation characteristics of optical waveguides. E.K.Sharma, A.K.Ghatak (Dept. of Phys., Indian Inst. of Technol., Delhi, India), I.C.Goyal.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1231-3 (Aug. 1983).
The authors have transformed the scalar wave equation into a matrix eigenvalue equation, the diagonalization of which gives the guided modes and a

discrete representation of the radiation modes. The method is simple and can be used for arbitrary refractive index profiles. (8 refs.)

118270 Propagating beam analysis of multimode waveguide tapers. B.Hermansson, D.Yevick (Inst. of Optical Res., Stockholm, Sweden), P.Danielsen.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1246-51 (Aug. 1983).
The authors analyze both slowly and rapidly varying tapers with the aid of the propagating beam method. The authors' results demonstrate that while the optimal longitudinal profile for slowly varying profiles is independent of the taper length, the optimum profile of a taper which varies rapidly with respect to the inverse of the average propagation constant difference of adjacent modes must be determined computationally in each case from the given values of its length and initial and final width parameters. The authors also analyze the region of validity of local normal mode perturbation theory in representation taper configurations. (7 refs.)

118271 Emission of light from a strip waveguide with periodically varying parameters. V.A.Sychugov, A.V.Tishchenko (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.344-8 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR),* vol.10, no.3, p.580-8 (March 1983). [received: Oct. 1983]
A theoretical analysis is made of the problem of the emission of light from a strip waveguide, formed inside a planar waveguide, into the latter waveguide and into the media surrounding it. A calculation is made of the spectral and angular characteristics of the process of emission of light into the planar waveguide. Estimates are obtained of the fraction of the power of light emitted into the planar waveguide. It is shown that a corrugated strip waveguide may be used in integrated-optics devices for demultiplexing of wavelength-division multiplexed optical communication channels. (6 refs.)

118272 Theoretical investigation on the applicability of the ATR-technique to thin-films measurements by guided waves. L.Leine (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.99-106 (1983). In English.
The ATR-technique has been investigated using guided waves to determine thin film parameters. The gaussian beam and the plane wave model have been compared by computation angular dependent ATR-spectra. Main attention has been given to the effect of laser beam width, air-gap width and the mode order of guided waves on the spectra. The waveguiding film parameters have been determined by fitting a computer program for the gaussian beam and plane wave model respectively. All computations have demonstrated that the plane wave model is unsuitable to determine thin film parameters from ATR-measurements, because the attained error is too large. It has been shown that the one-dimensional gaussian beam is a good approximation for calculations. (14 refs.)

118273 Ion-implanted waveguides. H.Karge, H.Just, R.Prager (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.147-58 (1983). In German.
Ion implantation into several optical materials changes the refractive index in near surface regions by radiation damage and incorporation of the implanted ions. The different applications of this effect for production of waveguide structures are discussed. The possibilities of the method are shown for the case of ion implanted waveguides in LiNbO$_3$, quartz and fused silica. (31 refs.)

Low-threshold InGaAsP ridge waveguide lasers at 1.3 μm .... See Entry 118164

Spectrophone stabilization and offset tuning of a carbon dioxide waveguide laser .... See Entry 118187

Monomode-polarization-maintaining fiber directional couplers .... See Entry 118290

Chirped grating lenses in Ti-indiffused LiNbO$_3$ optical waveguides .... See Entry 118304

Micro-optical 3-dB mode converters .... See Entry 118306

Electro-optic branching-waveguide switch with low drive voltage .... See Entry 118307

Embossing technique for fabricating integrated optical components in hard inorganic waveguiding materials .... See Entry 118312

42.80M Fibre optics

118274 Single-mode W-fibres with profile-threshold for low dispersion over a wide spectral range. A.Majewski, H.G.Unger (Tech. Univ. Braunschweig, Braunschweig, Germany).
Arch. Elektron. & Uebertragungstech. (Germany), vol.37, no.9-10, p.336-8 (Sept.-Oct. 1983).
Single-mode W-fibres with a threshold layer of raised index surrounding their inner cladding are designed to have zeroes of dispersion coefficient at three different wavelengths, and as a consequence typically less than 1 ps/(nm km) dispersion over a wavelength range of nearly 0.4 μm. (11 refs.)

118275 Fiberoptic communications. Status and prospects for development. E.M.Dianov (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.160-72 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.,* vol.44, no.8, p.1754-69 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980). (40 refs.)

118276 Fiber optics: new technology or an old idea?.
Wire J. Int. (USA), vol.16, no.8, p.33-4 (Aug. 1983).
Fiber optics technology has progressed at a rapid pace in recent years. Currently (1983), technologists in the United States and abroad are working on a wide variety of programs which, among other things, are aimed at developing: optical transmitters, receivers and fibers for carrying light signals in longer wavelengths that will make possible longer transmission links without installing regenerators along the way; wavelength division multiplexing; new integrated circuits containing on a single chip all the devices needed for transmitting, regenerating and receiving optical signals; optical switching systems that will process telephone calls in the form of light pulses rather than as the traditional electrical signals; single-mode optical fibers that will carry just one ray of light and thus offer a broader highway for handling many more phone calls. (no refs.)

118277 Single mode laser spectral spread repercussion in single-mode optical fiber coherent detection systems. P.Gallion, F.J.Mendieta, C.Chabran (Dept. Electronique et Phys., Ecole Nat. Superieure des Telecommunications, Paris, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.527-31 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Single frequency laser source phase noise constitutes a limitation in single-mode optical fiber coherent detection systems such as heterodyne communication receivers and optical fiber interferometric sensors. The authors investigate the phase noise affecting the beat photocurrent produced by the coherent detection of a single frequency laser field with a time-delayed and frequency-shifted image of itself in a heterodyne interferometer. The photocurrent spectrum is discussed as a function of the source lineshape and interferometer decorrelation time. An experimental study is reported consisting of a single-mode fiber Mach-Zender interferometer employing a single-frequency laser and an acousto-optical modulation for frequency-shifting one of the interferometer arms. Results are in good agreement with theory. (8 refs.)

118278 Optical fibre sensors for displacement measurement. M.C.Hutley (Div. of Mech. & Optical Metrology, NPL, Teddington, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.376, p.37-41 (1983). (Optical Sensing Techniques, Benefits, Costs, Teddington, Middx., England, 7-8 Dec. 1982).
The author believes that a rational and economical development of optical fibre sensors can best be achieved by a universal measuring system which can readily be adapted to measure a range of parameters. It appears that the measurement of displacement is most likely to fulfil this need and the author has considered two systems by which this can be achieved. In particular, a wavelength encoded sensor system appears to have much to offer. The author has assembled for demonstration purposes an example of such a system measuring pressure, displacement, mass and level. His purpose in producing this has been to illustrate one form that such a system might take and to invite from potential users and manufacturers comments which will help the rapid development of a fully operational system. This particular system has several advantages but it is not susceptible to wavelength division multiplexing and is rather wasteful of light. However, it does have the advantage that it can be put into operation using existing technology so that even if it is not the eventual choice for a universal sensing system, it may nevertheless play a useful role in defining the form that system will have. (5 refs.)

118279 The promise of the future [low-loss optical fibres]. A.R.Tebo.
Electro-Opt. (USA), vol.15, no.6, p.41-6 (June 1983).
The development of heavy-metal-fluoride glasses for mid-infrared optical fibers for telecommunications is following the path of slow progress traversed by silica fibers, but the prospects for ultralow-loss fibers make it all worthwhile. (26 refs.)

118280 Fabrication of polarisation-maintaining [3×3] single-mode-fibre couplers. M.Kawachi (Ibaraki Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Ibaraki, Japan).
Electron. Lett. (GB), vol.19, no.19, p.781-2 (15 Sept. 1983).
[3×3] fused fibre couplers have been fabricated with polarisation-maintaining and absorption-reducing (PANDA) fibres. The couplers can hold linear polarisation along the principal axis of the fibre branches, showing an extinction ratio better than −15 dB. (7 refs.)

118281 8 km-long polarisation-maintaining fibre with highly stable polarisation state. Y.Sasaki, T.Hosaka, K.Takada, J.Noda (Ibaraki Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Ibaraki, Japan).
Electron. Lett. (GB), vol.19, no.19, p.792-4 (15 Sept. 1983).
A new preform fabrication technique for realising long lengths of polarisation-maintaining optical fibres is described. The technique is shown to produce stress-induced birefringent fibres with symmetry and uniformity along the length in the stress-applying parts. The resultant 8.3 km-long fibre whose relative refractive-index difference is 0.6% has been obtained with a crosstalk of −23 dB at 1.15 μm wavelength, where the loss is 1.7 dB/km. (8 refs.)

118282 Acousto-optic frequency shifter for single-mode fibres. K.Nosu, S.C.Rashleigh, H.F.Taylor, J.F.Weller (Naval Res. Lab., Washington, DC, USA).
Electron. Lett. (GB), vol.19, no.20, p.816-18 (29 Sept. 1983).
A fibre-optic frequency shifter has been constructed using a birefringent single-mode fibre positioned asymmetrically within two acoustic resonators driven 90° out of phase. The incident wave in one polarisation state is coupled to a frequency-shifted wave in the orthogonal state. Sideband suppression of better than 20 dB is achieved. (6 refs.)

118283 Polarisation-preserving coupler with self aligning birefringent fibres. W.Pleibel, R.H.Stolen (Bell Labs., Holmdel, NJ, USA), S.C.Rashleigh.
Electron. Lett. (GB), vol.19, no.20, p.825-6 (29 Sept. 1983).
Polarisation-preserving directional couplers have been fabricated with birefringent fibres that self align their axes within the coupling region. The polarisation characteristics have been measured with the reliable spectral-averaging technique, and broadband extinction ratios of −20 dB have been achieved, on average, in all ports. (12 refs.)

118284 γ-ray irradiation effect on transmission loss for ZrF$_4$-based optical fibres. Y.Ohishi, S.Mitachi, S.Takahashi, T.Miyashita (Nippon Telegraph & Telephone Public Corp., Ibaraki, Japan).
Electron. Lett. (GB), vol.19, no.20, p.830-1 (29 Sept. 1983).
The γ-ray irradiation effect on the transmission loss of ZrF_4-BaF_2-GdF_3-AlF_3 and ZrF_4-BaF_2-GdF_3-AlF_3-PbF_2 optical fibres is investigated. Absorption bands are induced in the ultraviolet to near infrared region, and their tails increase the transmission losses in the mid-infrared region. Induced transmission losses for a dose of 10^6 R are 1000-2300 dB/km in the 2-4 μm band. These values are comparable to those at 1.5 μm for doped silica fibres. (6 refs.)

118285 Birefringence and polarization mode dispersion caused by thermal stress in single mode fibers with various core ellipticities. N.Shibata (Ibaraki Electrical Communication Lab., NTT, Ibaraki-ken, Japan), M.Tateda, S.Seikai, N.Uchida.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.8, p.1223-7 (Aug. 1983).
Modal birefringence and polarization mode dispersion in single-mode fibers with various core ellipticities were measured at wavelengths in the 0.633-1.5 μm region. From the measurements and numerical calculations of the birefringence and the modal dispersion due to a geometrical anisotorpy by the point-matching principle, normalized frequency dependence of the birefringence and the dispersion caused by a thermal stress were clearly obtained for various core ellipticities. Comparing the evaluated results with the calculation within the first-order perturbation theory, it is found that the evaluated curves for core ellipticity of 20 percent are coincident fairly well with that of

theory, while the curves for core ellipticity of 58 percent are shifted markedly toward higher v value region. (14 refs.)

118286 Connector for optical fiber light conductor. C.E.Hayward (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.3B, p.1603 (Aug. 1983).
An optical fiber light conductor is attached to a fusion splicing connector that makes a screw connection to a connector that is attached to another light conductor or to a light sending or receiving apparatus. (no refs.)

118287 Evaluation of the fatigue constant n in optical fibers with surface particle damage. F.A.Donaghy, D.R.Nicol (AWA Res. Lab., Amalgamated Wireless (Australia), NorthRyde.Ltd.,NSW, Australia).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.601-4 (Aug. 1983).
A method of controllably damaging the surface of silica-based optical fibers is described, producing in short lengths the tensile strength typical of long proof-tested lengths. The stress corrosion constant n is obtained relatively rapidly, by correlating the results of static and dynamic fatigue measurements. For damaged 125-μm-diameter fibers, with an average strength of 1.25 GPa, a value for $n=20$ was found, similar to that in pristine fibers. (18 refs.)

118288 Fibre optic transmission—the long-term solution. L.Critchley.
New Electron. (GB), vol.16, no.16, p.55 (16 Aug. 1983).
Compared with conventional wiring in electronic systems, fibre optics necessitates additional components and a more expensive link. However, this apparent disadvantage can be immediately outweighed by the inherent advantages of a fibre optic cable. The author discusses the three types of fibre. (no refs.)

118289 Fiber-optic gyroscope with polarization-holding fiber. W.K.Burns, R.P.Moeller, C.A.Villarruel, M.Abebe (Naval Res. Lab., Washington, DC, USA).
Opt. Lett. (USA), vol.8, no.10, p.540-2 (Oct. 1983).
A fiber gyroscope is reported that uses polarization-holding fiber in the coil, the phase modulator, and the coupler. The random-drift coefficient, calculated from RMS noise levels, was 8.10^{-4} deg/$\sqrt{}$h, within a factor of 2 of an experimentally determined quantum and thermal limit. White-noise behavior was observed for integration time constants from 1 to 40 sec. Device characteristics and performance are presented. (13 refs.)

118290 Monomode-polarization-maintaining fiber directional couplers. B.K.Nayar, D.R.Smith (British Telecom Res. Labs., Ipswich, England).
Opt. Lett. (USA), vol.8, no.10, p.543-5 (Oct. 1983).
The fabrication and experimental evaluation of monomode-fiber directional couplers having polarization-maintaining elliptical-cored fibers is described. The couplers have a polarization isolation of greater than 40 dB and insertion losses of less than 0.5 dB. (8 refs.)

118291 Measurement of polarization mode coupling along a polarization-maintaining optical fiber using a backscattering technique. M.Nakazawa, M.Tokuda, Y.Negishi (Ibaraki Electrical Communication Lab., NTT, Ibaraki, Japan).
Opt. Lett. (USA), vol.8, no.10, p.546-8 (Oct. 1983).
A new technique for measuring the polarization mode coupling of a polarization-maintaining optical fiber has been proposed that uses a modified optical time-domain reflectometry in which two kinds of backscattered signals coming through each principal axis of the fiber are utilized. This technique shows how the mode coupling occurs along the fiber. The extinction ratio evaluated by the present technique is in good agreement with that obtained by a conventional technique (with ±0.5 dB). (11 refs.)

118292 From fibre optics to an actual system. J.L.Tondi Resta, J.A.Carmona, R.A.Ares.
Rev. Telegr. Electron. (Argentina), vol.71, no.840, p.404-7 (May 1983). In Spanish.
The authors mention those characteristics of optical fibres which must be known in order to design a system. They describe an optical fibre with its core and cladding and mention that it may have one or several transmission modes. Despite difficulties in manufacture, single mode fibres are ideal for operation in the second and third low attenuation windows. After discussing the advantages and disadvantages of multimode fibres, the authors discuss the stationary distribution of the modes, deal with the measurement of attenuation including a destructive method and a non-destructive method. Finally the authors describe various experimental methods used to determine the stationary distribution of the modes and evaluate the results obtained. (4 refs.)
G.W.

118293 Radiation-optical properties of quartz glass fiber-optic waveguides (review). E.M.Dianov, L.S.Kornienko, E.P.Nikitin, A.O.Rybaltovskii, V.B.Sulimov, P.V.Chernov (P.N. Lebedev Phys. Inst., Acad. of Sci, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.274-89 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.473-96 (March 1983). [received: Oct. 1983]
A review is given of the radiation-optical properties of glass fiber-optic waveguides. Particular attention is paid to an analysis of radiation-induced absorption in multimode fiber-optic waveguides having pure and doped quartz glass cores. Dependences of the induced absorption on the dose, power, and type of radiation, on the temperature, the concentration of dopants and hydroxyl groups in the core, and on the wavelength and power of the probe radiation are discussed. An analysis is made of the kinetic curves of the changes in the induced absorption both during and after exposure to the radiation. Some models describing the effects of radiation bleaching and optical bleaching are analyzed. The propagation of a bleaching pulse through a radiation-darkened waveguide is examined. (66 refs.)

118294 Dependences of the polarization properties of polymer graded-index fibers of the Selfoc type. N.G.Gachechiladze, S.I.Grigor'ev, M.G.Zguladze, A.N.Mestvirishvili, V.R.Sagaradze (Inst. of Cybernetics, Acad. of Sci., Tbilisi, Georgian SSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.377-8 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.627-9 (March 1983). [received: Oct. 1983]
Temperature dependences of some polarization characteristics were determined for polymer Selfoc-type fibers. It was found that when plane-polarized light passed through a fiber of this kind, it emerged with elliptic polarization. The effective direction of the polarization of light emerging from a fiber was shifted by an angle $\Delta\phi$ from the plane of polarization of the incident wave. The temperature dependence of $\Delta\phi$ was studied. It was found that the investigated graded-index fibers were optically biaxial. (8 refs.)

118295 Optical fiber coupling of 1.2-1.6 μ radiation emitted from buried mesastripe injection lasers. V.P.Duraev, P.G.Eliseev, S.S.Kurlenkov, I.A.Skopin (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.382-4 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.633-5 (March 1983). [received: Oct. 1983]
An investigation was made of the efficiency of coupling—into fiber waveguides—of 1.2-1.6 μ radiation emitted by a buried mesastripe InGaPAs-InP heterojunction laser. The maximum power of the radiation coupled into a fiber waveguide was 16 mW in the CW regime at room temperature. The coupling efficiency was 90% in the case of a multimode fiber waveguide and 36% in the case of a single-mode waveguide when matching was provided by a microlens with a radius of $\sim 10\ \mu$. (8 refs.)

118296 Development of optical fibres by the VAD method. T.Kojima, F.Nakane, K.Muta, K.Adachi, O.Shinji.
Showa Wire & Cable Rev. (Japan), vol.33, no.1, p.39-43 (1983). In Japanese.
The VAD (Vapor-phase Axial Deposition) method is becoming widely used to manufacture optical fibers because of its excellence in mass production and applicability to any needs. In practical use, it is most important to examine reliability. This paper gives a survey of the VAD method, and the transmission properties and reliability of the VAD fibers. This investigation proves that optical fibers manufactured by the VAD method have as long term reliability in transmission properties and mechanical strength as those by the CVD (Chemical Vapor Deposition) method. (4 refs.)

118297 Effects of tension on the refractive-index distribution and the transmission characteristics of a coated optical fiber. Y.Satomura (Faculty of Engng., Osaka Electro-Communication Univ., Neyagawa, Japan), E.Mimura, N.Kumagai.
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.7, p.537-8 (July 1983). In Japanese.
The effects of the axial tension on the refractive index distribution and the transmission characteristics of a coated step-index optical fiber are investigated theoretically. The stress- and the index-distributions are derived respectively from an elastic theory and a photoelastic effect and some numerical examples are also presented. (3 refs.)

118298 Fibre optics for feeder applications. R.Subramanian, J.Weiss.
Telephony (USA), vol.205, no.8, p.36, 40, 44, 46 (15 Aug. 1983).
The application of fiber optic technology in the access network so far has been considered only as a future practicality. This article presents the strategic components underlying the choice between digital copper and fiber feeders. The major issues addressed include system architecture and design, performance objectives, implementation, economic analysis, operations and maintenance, and qualitative assessment of voice-data services and wideband services requirements. (no refs.)

118299 Working with glass takes a lighter touch [fibre optic cables]. J.L.Vallosio (General Telephone Co. of Pennsylvania, York, PA, USA).
Telephony (USA), vol.205, no.10, p.28-30 (29 Aug. 1983).
Discusses ways of adapting traditional telephone construction techniques to fibre optic cable. The installation of an eight-fibre optical trunk cable by General Tel of Pennsylvania is described. This project required the placing of fibre optic cable in both underground and aerial locations. A major problem was adapting specialized splicing techniques, but this was solved by using the Elastomeric Splice manufactured by GTE Electronic Components Div. of GTE Precision Materials. (no refs.)

118300 Semiautomatic applications of low cost fiber optic connectors. J.A.Leidy (Signal Components Div., AMP Inc., Harrisburg, PA, USA).
Electro/82 Conference Record, Boston, MA, USA, 25-27 May 1982 (El Segundo, CA, USA: Electron. Conventions 1982), p.27-5/1-5
The OPTIMATE DNP connector system and its semiautomatic application equipment in combination with low cost devices and fiber provides the first major advance in cost effective optics for the consumer durables, industrial, and data systems market. This connector system has been designed to operate with 1000 micron plastic optical fiber. The various device mounts interface both TO 92 style packages and modified TO 18 style packages. The system is based on a single or dual plug which uses a primary alignment mechanism consisting of two opposing V-grooves for centering the fiber to ensure less than 3 dB insertion loss when end finish is achieved with a hot cut-off blade. The plug is then centered into the receptacle by taking advantage of four protrusions which accurately locate the plug into the receptacle. (no refs.)

Optical systems and sensors for measurement and control .... See Entry 117163

Evanescent amplification in a single-mode optical fibre .... See Entry 118136

Ultraviolet four-photon mixing in a multimode silica fiber Raman amplifier .... See Entry 118215

Optical sensor with fibre optic links: a shutter modulator ..... See Entry 118264

Future technological applications of rare-earth-doped materials .... See Entry 120755

42.80Q Image detectors, convertors, and intensifiers

118301 Performance of active and passive night viewing systems under low ambient illumination levels. J.C.Monga, B.D.Bhawe (Bhabha Atomic Res. Centre, Bombay, India).
Opt. & Laser Technol. (GB), vol.15, no.5, p.259-62 (Oct. 1983).
A comparison of the estimated field performance of some typical active and passive night viewing systems under low illumination levels is presented. In addition to the 'range', a generalized figure of merit, the minimum detectable object size (MIDOS), is suggested and used as a basis of comparison. The influence of the optics and other parameters is discussed and the usefulness of the results in the optimization of system design is illustrated. The results indicate that active systems perform better than similar passive systems under certain commonly encountered ambient conditions. (9 refs.)

Image-converter recording of picosecond pulses emitted by an erbium laser ($\lambda=2.94\ \mu$) with active mode locking .... See Entry 118190

The Mangin mirror as imaging element .... See Entry 118245

42.80S Optical communications devices

118302 Total-reflection wavelength demultiplexer using a highly dispersive medium. M.Tateda, F.Kanaya (Musashino Electrical Communication Lab., NTT, Tokyo, Japan).
Opt. Lett. (USA), vol.8, no.10, p.531-3 (Oct. 1983).
The authors propose a new type of optical wavelength demultiplexer that employs the wavelength dependence of reflectivity at the interface plane for two media having different dispersive characteristics. This device utilizes a total-reflection phenomenon and guarantees a perfectly zero cross talk or less than 4×10^{-4} cross talk, respectively, at any wavelength shorter or longer than the design-window-wavelength region. (7 refs.)

Ultrashort optical pulse generation from microwave modulated AlGaAs diode laser with Selfoc rod resonator .... See Entry 118178

Emission of light from a strip waveguide with periodically varying parameters .... See Entry 118271

Fiberoptic communications. Status and prospects for development .... See Entry 118275

Fiber optics: new technology or an old idea? .... See Entry 118276

Single mode laser spectral spread repercussion in single-mode optical fiber coherent detection systems .... See Entry 118277

Connector for optical fiber light conductor .... See Entry 118286

Electro-optic branching-waveguide switch with low drive voltage .... See Entry 118307

42.82 INTEGRATED OPTICS

(for optical waveguides see also 42.80L)

118303 Integrated-optics elements and systems. V.N.Morozov, V.A.Pletnev, Yu.M.Popov, V.L.Smirnov.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.78-92 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1651-69 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
Research in the field of integrated optics is reviewed. The basic methods used to build waveguides and use them in diffraction-grating structures, planar lenses, polarizers, directional couplers, modulators, deflectors, and other waveguide elements for optical communications lines and data-processing devices are described. (125 refs.)

118304 Chirped grating lenses in Ti-indiffused $LiNbO_3$ optical waveguides. W.S.C.Chang, S.Forouhar, J.M.Delavaux, C.Warren, Ron-Xin Lu (Dept. of Electrical Engng. & Computer Sci., Univ. of California, La Jolla, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.581-90 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Chirped grating lenses have been successfully designed, fabricated and evaluated for the first time on Ti-indiffused $LiNbO_3$ waveguides. The design procedure, the expected and measured performances, the materials and fabrication processes developed, and the performance limitations imposed by the waveguide parameter and by the fabrication tolerances are presented. (5 refs.)

118305 Integrated optical microwave spectrum analyser (IOSA) using geodesic lenses. G.F.Doughty, R.M.DeLaRue, N.Finlayson, J.Singh, J.F.Smith (Electronics & Electrical Engng. Dept., Univ. of Glasgow, Glasgow, Scotland).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.705-10 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The authors report on an IOSA based on a titanium diffused optical waveguide layer in lithium niobate with geodesic lenses. Lenses were designed by the method of Sottini et al. but with essential modifications to smooth over regions of extreme curvature. Ray-tracing analysis showed that the deviation from the ideal profile introduced by this smoothing had negligible effect. Several lens fabrication methods were experimentally evaluated—ultrasonic impact grinding, computer-controlled diamond tool grinding and diamond turning, followed by polishing with large area flexible tools, or with small pads under microprocessor time and position control. The most reliable method was diamond turning followed by polishing with a small pad on a specially constructed computer controlled polishing machine. Data are also presented on factors affecting overall spectrum analyser dynamic range such as inplane scattering and acousto-optic third-order intermodulation. (12 refs.)

118306 Micro-optical 3-dB mode converters. P.S.Chung (School of Electrical Engng. & Computer Sci., Univ. of New South Wales, Kensington, NSW, Australia).
Opt. & Laser Technol. (GB), vol.15, no.5, p.263-8 (Oct. 1983).
Presents a detailed design of a 3-dB TE_0-TE_1 micro-optical mode converter using a chirped grating to phase-match the two propagation modes in an optical waveguide. Devices were fabricated in titanium in-diffused lithium niobate by ion-beam etching the tapered grating pattern into the waveguide surface. The power transfer between the two coupled modes was observed experimentally by varying the angle between the light beam and the normal grating wave-vector. Insertion loss of the TE_0-TE_1 mode converter due to spurious scattering was estimated at 1.5 dB. (15 refs.)

118307 Electro-optic branching-waveguide switch with low drive voltage. M.Haruna, T.Hibi, J.Koyama (Dept. of Electronics, Faculty of Engng., Osaka Univ., Osaka, Japan).
Opt. Lett. (USA), vol.8, no.10, p.534-6 (Oct. 1983).
Both experimental and theoretical results of a low-voltage-driven optical branching-waveguide switch in Z-cut $LiNiO_3$ are presented. In a 10-μm-wide single-mode branching-waveguide switch for $\lambda_0=0.6328$ μm, the 10-dB extinction ratio was obtained at a drive voltage as low as ±6.5 V, although ±40 V was required in a 4-μm-wide switch. The scattering loss of the guided mode at the branching point was evaluated to be 1.3 dB. (12 refs.)

Optical systems and sensors for measurement and control .... See Entry 117163

Low-threshold InGaAsP ridge waveguide lasers at 1.3 μm .... See Entry 118164

An array of optical stripe wave guides .... See Entry 118266

Ion beam etching in InP. I. Ar ion beam etching and fabrication of grating for integrated optics .... See Entry 118310

Embossing technique for fabricating integrated optical components in hard inorganic waveguiding materials .... See Entry 118312

42.85 OPTICAL TESTING AND WORKSHOP TECHNIQUES

118308 Diamond machining. The impact on rotating scanners. W.Caithness, J.Eisenberger, A.W.Naugler.
Photonics Spectra (USA), vol.17, no.8, p.65-6, 68 (Aug. 1983).
Diamond machining has had a major impact on the cost of rotating mirror scanners by taking the highly trained optician out of the production loop. In addition, the new technology makes much of the expensive ancillary equipment needed for the old process obsolete. All of this comes not at the price of reduced quality but with the added benefit of new capabilities. With diamond machining, scanner manufacturers can vary face-to-axis pyramidal angles and produce a large production run of identical parts at a tremendous cost saving. (no refs.)

118309 Self-guiding method for ruling diffraction gratings. Liang Hao-ming, Hao De-fu (Changchun Inst. of Optics & Fine Mech., Chinese Acad. of Sci., Changchun, China).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.666-72 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Presents a new approach to rule a long diffusion grating, in which a short ruled portion of the ruling grating blank is used as a new dividing element of the engine to continue its ruling. The main ruling errors are analysed and some formulae for the calculation of these errors are derived. The actual resolution of a specimen is 90% of its theoretical value. The tentative results have verified the correctness of the principle links to this method. (1 ref.)

118310 Ion beam etching in InP. I. Ar ion beam etching and fabrication of grating for integrated optics. Y.Yuba, K.Gamo, H.Toba, X.G.He, S.Namba (Faculty of Engng. Sci., Osaka Univ., Osaka, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1206-10 (July 1983).
The Ar ion beam etching (IBE) of InP has been studied in order to clarify its applicability as a microfabrication technique for devices with submicron geometry such as integrated optics devices. The IBE rate has been determined as a function of ion energy, current density and angle of beam incidence. The crystalline quality of the etched surface has been investigated by electron beam diffraction, Rutherford backscattering and photoluminescence measurements. The etched surface has a polycrystalline phase and recovers to a single crystal after annealing at 500°C. Grating structures with a period of around 2600 A have been fabricated on an InP surface by the Ar-IBE combined with a holographic-photoresist-exposure technique. (15 refs.)

118311 Design solution of the intensification of the production of optical elements. S.Minar.
Jemna Mech. & Opt. (Czechoslovakia), vol.28, no.6, p.161-5 (June 1983). In Czech.
The author discusses special problems encountered in optical materials processing and considers possibilities of improving the effectiveness of optical workshop techniques. In particular, the use of diamond tools and the trend towards automation of the optical workshop techniques are discussed. (28 refs.) *E.D.*

118312 Embossing technique for fabricating integrated optical components in hard inorganic waveguiding materials. W.Lukosz, K.Tiefenthaler (Swiss Federal Inst. of Technol., ETH, Zurich, Switzerland).
Opt. Lett. (USA), vol.8, no.10, p.537-9 (Oct. 1983).
The authors describe a novel embossing technique for fabricating integrated optical components in hard and resistant inorganic waveguiding materials of good optical quality. The desired structure is embossed into a dip-coated deformable gel film prepared from organometallic solutions. Subsequent heat treatment transforms it into inorganic hard oxide material. They have successfully fabricated surface-relief gratings with 1200 lines/mm on SiO_2-TiO_2 waveguides (with refractive index $n_F \simeq 1.8$, thickness $d_F \simeq 120$ nm, and loss <1 dB/cm). The embossed gratings served as input and output grating couplers and as Bragg reflectors. The authors propose to fabricate other integrated optical components for example, channel waveguides, with this method. (3 refs.)

118313 Coherent-optical control of the quality and shape of reflecting objects. V.G.Volostnikov, V.A.Katulin, V.V.Kotlyar, A.N.Malov (P.N. Lebedev Phys. Inst., Acad. of Sci., Kuibyshev, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.396-8 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.649-52 (March 1983). [received: Oct. 1983]
A description is given of a relatively simple method for determining imperfections of the shape and microdefects on the reflecting surfaces of solids of revolution (balls and rollers). It is shown that the method is characterized by an interference sensitivity to surface geometry defects and by a relatively high immunity to errors. (5 refs.)

118314 The theory and apparatus of laser interferometric centring. Yu Zhongru, Yuan Junyi (Optical Instruments Dept., Zhejiang Univ., Zhejiang, China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.209-18
Describes a high precision lens-centring system used to assemble some high-precision photolithographic lenses on the basis of a height-difference laser interferometry. The structure of the interferometric lens-centring system, its theory, the necessary equations and diagrams, and the breadboard setting are given. The centring accuracy for lenses with radii ranging from 12 mm to 432 mm is 1″/1 μm which is almost one order higher than the classical optical centring method. (18 refs.)

Rigorous diffraction theory applied to video disk geometries .... See Entry 118068

Effect of figure and waviness on image quality .... See Entry 118089

New methods for ruling long diffraction gratings .... See Entry 118263

Ion-implanted waveguides .... See Entry 118273

Fabrication of polarisation-maintaining [3×3] single-mode-fibre couplers .... See Entry 118280

8 km-long polarisation-maintaining fibre with highly stable polarisation state .... See Entry 118281

Development of optical fibres by the VAD method .... See Entry 118296

Chirped grating lenses in Ti-indiffused $LiNbO_3$ optical waveguides .... See Entry 118304

Integrated optical microwave spectrum analyser (IOSA) using geodesic lenses .... See Entry 118305

examination of concave and convex aspherical mirrors with a T-shaped spherometer .... See Entry 121531

43.00 ACOUSTICS

(for audition, see 87.34; for speech, see 87.36; for sound effects on living matter, see 87.50C)

43.20 GENERAL LINEAR ACOUSTICS

(see also 03.40K Mathematical problems in waves and wave propagation)

118315 Acoustic model of the sea floor. Calculation of the complex coefficient of reflection, $\tilde{R}(\omega)$, for a semiinfinite medium with a density gradient. R.Carbo Fite, M.Camarasa Rius, C.Ranz Guerra (UEI de Hideroacustica, Inst. de Acustica, Madrid, Spain), A.M.Soler Navarro.
An. Fis. Ser. B (Spain), vol.79, no.2, p.108-14 (May-Aug. 1983). In Spanish. [received: Oct. 1983]
Presents the theoretical study of sound wave propagation in an inhomogeneous medium with density gradient. The results were applied to obtain the reflection coefficient of the dioptric formed by a semiinfinite homogeneous medium (water) and a semiinfinite inhomogeneous medium with density gradient, and finally the reflection coefficient of a inhomogeneous layer of a given thickness and density gradient, sandwiched between two homogeneous and semiinfinite media (water and hard basement). It was concluded that the reflection coefficient of the layer varies with frequencies in a nontypical way at low frquencies while at high frequencies shows a periodic variation. (7 refs.)

118316 Resonance scattering of acoustic waves by a fluid spheroid. M.I.Dzyubachik.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.35-8 (1983). In Ukrainian.
Each normal wave is shown to contain a series of resonance terms at frequencies obtained from dispersion equations. Analytical expressions are obtained for resonance parameters. (8 refs.)

118317 Higher order mode acoustic transmission through the walls of rectangular ducts. A.Cummings (Dept. of Mech. & Aerospace Engng., Univ. of Missoui, Rolla, MO, USA).
J. Sound & Vib. (GB), vol.90, no.2, p.193-209 (22 Sept. 1983).
As an extension of previous work on low frequency fundamental mode acoustic transmission through the walls of rectangular ducts, results are presented on the transmission of internally propagated higher order acoustic modes through the duct walls. Subject to various assumptions, it is possible to obtain a closed form solution to the structural wave equation governing the motion of the duct's walls, and this is used to predict the response of the walls to the internal pressure field. The resultant acoustic radiation is estimated here by assuming that the duct radiates like a circular cylinder with the same surface velocity distribution. Both experimental and theoretical results are given and agreement between the two is tolerably good. (16 refs.)

118318 Approximate asymptotic solutions for acoustic transmission through the walls of rectangular ducts. A.Cummings (Dept. of Mech. & Aerospace Engng., Univ. of Missouri, Rolla, MO, USA).
J. Sound & Vib. (GB), vol.90, no.2, p.14-27 (22 Sept. 1983).
Approximate expressions—valid at sufficiently high frequencies—are obtained for the acoustic transmission loss of the walls of rectangular ducts. Single mode propagation inside the duct, both in the fundamental mode and in higher order modes, is considered and a multimode model is also proposed. These theories lead to very simple formulae for the transmission loss, which prove to be in tolerably good agreement with measurements. (12 refs.)

118319 Sound radiation from finite length axisymmetric ducts. W.L.Meyer, B.T.Zinn (Georgia Inst. of Technol., Atlanta, GA, USA).
J. Sound & Vib. (GB), vol.90, no.2, p.286-90 (22 Sept. 1983).
The approach used in this study to analyze the duct radiation problem is based upon the numerical solution of a special cylindrically symmetric integral representation of the external solutions of the Helmholtz equation. Since in this method one considers the combination of the interior and exterior sound fields to be a single entity, the acoustic quantities anywhere outside of the radiating body may be calculated. By employing this method not only can the radiated sound field be determined but the distribution of the acoustic quantities at the duct exit plane may be determined as well. The acoustic admittance (the ratio of the normal component of the acoustic velocity to the acoustic pressure) may be determined at the exit plane of the duct once the acoustic quantities have been calculated. This, the proper, radially varying boundary condition may be determined at the duct exit plane through the use of this method as well as the radiated sound field. (12 refs.)

118320 One procedure for inverting the Laplace transformation in problems of interaction between nonstationary waves and a spherical inclusion. A.G.Gorshkov, V.B.Poruchikov, D.V.Tarlakovskii.
Mech. Solids (USA), vol.18, no.1, p.75-82 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.18, no.1, p.82-90 (1983).
The most frequently employed method of solving axisymmetric problems of dynamics of a thick-walled elastic sphere that is filled and surrounded with elastic or acoustic media is the Laplace transformation with respect to time. With this approach, however, all the difficulties are carried over to the problem of calculating the original corresponding to the resultant solution in the transform space. The authors present a method for calculating the original based on a series expansion of the transforms in exponents. The resultant formulas make it possible to obtain an analytic solution for the problems under consideration. (7 refs.)

118321 Interior and exterior resonances in acoustic scattering. II. Targets of arbitrary shape (*T*-matrix approach). H.Uberall, G.C.Gaunaurd, E.Tanglis (Naval Surface Weapons Center, White Oak, Silver Spring, MD, USA).
Nuovo Cimento B (Italy), vol.77B, ser.2, no.1, p.73-86 (11 Sept. 1983).
For pt.I see ibid., vol.76, p.153 (1983). The *T*-matrix approach, which describes the scattering of acoustic waves (or of other waves) from objects of arbitrary shape and geometry, is here 'married' to the resonance scattering theory in order to obtain the (complex) resonance frequencies of an arbitrary shaped target. For the case of the nearly impenetrable targets, the authors split the partial-wave scattering amplitudes into terms corresponding to internal resonances, plus an apparently nonresonant background amplitude which, however, contains the broad resonances caused by external diffracted (or Franz-type, creeping) waves, in addition to geometrically reflected and refracted (ray) contributions. (10 refs.)

Electromagnetic and acoustic resonance scattering theory .....See Entry 118047

43.25 NONLINEAR ACOUSTICS AND MACROSONICS

(see also 43.60 Acoustic signal processing; 43.88 Transduction; devices for generation and production of sound)

Nonlinear theory of propagation of sound of intermediate frequency ....See Entry 119665

43.28 AEROACOUSTICS AND ATMOSPHERIC SOUND

(see also 92.60 Meteorology)

118322 An aeroacoustic model for high-speed, unsteady blade-vortex interaction. R.Martiniz, S.E.Widnall (MIT, Cambridge, MA, USA).
AIAA J. (USA), vol.21, no.9, p.1225-31 (Sept. 1983).
A three-dimensional aeroacoustic model is developed to predict the sound pulse radiated by the passage of a helicopter blade over a potential vortex. The linearized analysis assumes that either the blade-vortex separation is small or that the blade-tip Mach number is close to 1, or both, so that an acoustically noncompact situation exists. The three-dimensional blade loading due to blade-vortex interaction is constructed through a spanwise superposition of two-dimensional solutions with strength linearly increasing from hub to tip. Such a loading overestimates somewhat the strength of tip region dipoles in the acoustic calculation that follows. The final expression for the predicted far-field signature is obtained in closed form, and thus permits a relatively inexpensive calculation of the directivity of peak acoustic pressures in three dimensions. (12 refs.)

118323 Noise generation by a low-Mach-number jet. J.Laufer, Ta-chun Yen (Dept. of Aerospace Engng., Univ. of Southern California, Los Angeles, CA, USA).
J. Fluid Mech. (GB), vol.134, p.1-31 (Sept. 1983).
Using a 'clean' jet facility the relationship between the jet flow and its radiation field was studied experimentally in the Mach-number range $0.05<M_{\mathrm{j}}<0.20$ and a Reynolds-number range $6\times10^4<Re_{\mathrm{D}}<2.3\times10^5$. The various acoustic source parameters such as strength, frequency and Mach number were varied systematically, and the far-field pressure measured simultaneously. On the basis of these measurements the nature of the sources in the initial shear layer could be characterized. The principal results, equally valid for unexcited and excited jets, are as follows: the acoustic sources are not convected but are located within a confined volume fixed with respect to the nozzle even though they are being generated by moving disturbances in the jet; they are associated with the nonlinear saturation of the unstable wave amplitudes of the shear layer occurring at the vortex-pairing locations; the radiation intensity varies nonlinearly with the source strength and is highly directional, exponential in character. (19 refs.)

43.30 UNDERWATER SOUND

(see also 92.10 Physics of the ocean)

118324 Information principles of active sonar detection. Zhu Ye, Chen Geng (Inst. of Acoustics, Acad. Sinica, Peking, China).
Acta Acust. (China), vol.8, no.3, p.168-78 (May 1983). In Chinese. [received: Oct. 1983]
The relation between three main factors (waveform, channel and receiver) of active sonar is discussed. The models of the active sonar channel, which include marine reverberation, signal propagation and object scattering in sonar processes, are described, by a generalized scattering function and a generalized coherence function. Physical significance and measuring method of both functions are explained with the aid of channel output correlation functions and matched filter outputs. Finally, the fundamental principles for the design of the optimum waveform and the optimum receiver are presented. (15 refs.)

Ultrasound imaging ....See Entry 118339

Reflective properties from a low-velocity lake-bottom .... See Entry 121295

43.35 ULTRASONICS, QUANTUM ACOUSTICS, AND PHYSICAL EFFECTS OF SOUND

(for phonons in crystal lattices, see 63.; for plasma acoustics, see 52.35; for low-temperature acoustics and sound in liquid helium, see 67.; for acoustic properties of liquids, see 62.60; for acoustical properties of solids, see 62.65; for ultrasonic relaxation, see 62.80; for acoustic properties of thin films, see 68.60; for surface waves in solids, see 68.25; for acoustoelectric effects and acoustic wave amplification, see 72.50; for magnetoacoustic effects, oscillations and resonance, see 72.55; for acousto-optical effects and acoustic holography, see 78.20H and 43.63; for sound effects on living matter, see 87.50)

Enhanced age hardening of 7075 aluminum alloy after ultrasonic vibration ....See Entry 120342

43.40 MECHANICAL VIBRATIONS AND SHOCK

(see also 46.30M Vibrations, aeroelasticity, hydroelasticity, mechanical waves and shocks)

118325 Isolating apartments and offices from ground borne vibrations. P.Moss.
Noise & Vib. Control Worldwide (GB), vol.14, no.7, p.183-5 (Sept. 1983).
From the outside, Cresta House, situated in Finchley Road, London, UK, appears to be a fairly normal building structure; however, the entire superstructure from the foundation level upwards is built on elastomeric bearings. The project, which comproises flats, offices and shops, is situated next to the underground tunnel of the Metropolitan Railway line which runs parallel to and beneath Finchley Road at this point. Very early in the design stage, acoustics vibration and noise specialists, Grootenhuis Allaway Associates, were consulted for advice on the problems connected with ground-borne transmitted vibrations from nearby underground railways. It was found that vibration levels from previous site surveys carried out for similar projects, were such that if elastomeric bearings were not employed, perceptible levels of vibration would be felt in the proposed building structure. As the development comprised domestic flats and high quality office accommodation, the clients

decided it would be beneficial to ensure that steps had been taken to isolate the structure practically and economically. (no refs.)

Flexural vibration of truncated elliptical cone and Chinese chime bells .... See Entry 118335

On the transverse vibration of a rubber string .... See Entry 118476

43.50 NOISE, ITS EFFECTS AND CONTROL

(see also 86.70J Environmental science)

118326 Noise measurement and cost efficiency analysis exemplified by the 'whispering tractor'. B.Stasch.
Elektrotech. & Maschinenbau (EuM) (Austria), vol.100, no.8, p.340-2 (Aug. 1983). In German.
The author refers to the complexities of noise measurement and abatement and describes a tractor that was built on behalf of the Ministry of Health and Ecology in Vienna in conjunction with the Technical University there. Details are given for suppressing sound emission by 20 dB(A) in the propulsion system at 1 metre at maximum revolutions, and it is claimed that quiet tractors could be mass produced with only a 3-5 per cent increase in cost. The improvement pertains to diesel engines. Petrol-driven production model cars do not achieve comparable results and this indicates a need for research. (no refs.) *H.G.*

118327 Noise generated by airfoil profiles placed in a uniform laminar flow. H.Arbey, J.Bataille (Lab. de Mecanique des Fluides, Ecole Centrale de Lyon, Ecully, France).
J. Fluid Mech. (GB), vol.134, p.33-47 (Sept. 1983).
The authors' paper is devoted to the experimental study of the noise generated by an airfoil profile placed in a uniform laminar flow. The far-field acoustic spectrum is shown to be composed of a broadband contribution around frequency f_s and a discrete contribution at equidistant frequencies f_n, which follow power laws of the forms $f_s \sim U^{1.5}$ and $f_n \sim U^{0.85}$. Both contributions can be accounted for by a simple model derived from the original suggestions of Tam (1974) and Fink (1975). It is essentially assumed that the diffraction of the Tollmien-Schlichting instabilities by the trailing edge generates acoustic waves which propagate in the far field and also trigger an aeroacoustic feedback loop, whose length is equal to the distance between the trailing edge and the maximum velocity point of the airfoil. (17 refs.)

118328 Sounbd barriers to control noise.
Noise & Vib. Control Worldwide (GB), vol.14, no.7, p.195-7 (Sept. 1983).
In practice, acoustical enclosures are constructed to completely enclose the noise-emitting equipment, whilst sound barriers are installed, the main difference being that while a very high degree of sound insulation can be achieved with acoustical enclosures, sound barriers give much less satisfactory results. Sound insulating barriers (mostly moveable screens) are usually employed when unusual high-noise sources are to be rapidly but temporarily coped with, or when a full enclosure is not feasible. A rapid method is developed for evaluating the sound-deadening properties of a screen used indoors, when the premises' acoustic characteristics are fairly well known. (no refs.)

An aeroacoustic model for high-speed, unsteady blade-vortex interaction .... See Entry 118322

Noise generation by a low-Mach-number jet .... See Entry 118323

A dynamical estimation method of environmental noise system based on the quantized level measurement contaminated by the background noise .... See Entry 120797

43.60 ACOUSTIC SIGNAL PROCESSING

118329 A three dimensional model for generating the texture in B-scan ultrasound images. M.M.Goodsitt, E.L.Madsen, J.A.Zagzebski (Dept. of Medical Phys., Univ. of Wisconsin, Madison, WI, USA).
Ultrason. Imaging (USA), vol.5, no.3, p.253-79 (July 1983).
A three-dimensional model for production of gray scale texture in ultrasound B-mode images is described. The model computes time-dependent echo signals resulting from scattering of acoustic pulses by particles randomly distributed in an attenuating medium and transforms these signals into a gray scale image. Specific transducer and pulser-receiver characteristics are accounted for, as well as the three-dimensional nature of the problem, without loss of computational efficiency. The model generates texture that closely corresponds to that found experimentally in ultrasound images of tissue-mimicking phantoms. The dependence of the texture upon the depth of the region that was scanned and on the characteristics of the transducer-receiver system were clearly demonstrated. Good agreement between theory and experiment was found for the texture in phantoms containing simulated spherical low-scatter tumours. (18 refs.)

The improvement and quantitative assessment of B-mode images produced by an annular array/cone hybrid .... See Entry 121086

43.63 ACOUSTIC HOLOGRAPHY

118330 An application of holographic interferometry to acoustical holography. M.Ueda, K.Kagawa, S.Yamazaki, Y.Yoshikawa, K.Iwata (Faculty of Education, Fukui Univ., Fukui, Japan).
Optik (Germany), vol.65, no.3, p.219-26 (1983).
Holographic inteferometry with a phase-modulated reference beam is applied to acoustic holography. A very thin, flexible, optically reflective membrane, called a pellicle is used in the liquid as an acousto-optic interface. The method involves three processes: the motion of a pellicle caused by an ultrasonic wave is recorded as an optical hologram using holographic interferometry; the optical hologram is reconstructed to form an image on the pellicle which is used as an acoustic hologram; the acoustic hologram is finally used to reconstruct an image of the original object by illuminating it by laser light. A preliminary experiment is done with an ultrasound of frequency 1 MHz. (13 refs.)

43.70 SPEECH COMMUNICATION

(inc. speech perception, speech intelligibility, and speech synthesis; see also 87.36 Speech)

118331 Instantaneous voice period measurement for cochlear stimulation. D.M.Howard, A.J.Fourcin (Dept. of Phonetics & Linguistics, Univ. Coll. London, London, England).
Electron. Lett. (GB), vol.19, no.19, p.776-8 (15 Sept. 1983).
A peak-picking method for measuring the instantaneous period of voiced speech is described and compared with three other well documented techniques. It has been developed for use with a cochlear prosthesis to provide electrically stimulated hearing in a number of totally deaf adults. In this way both receptive and productive abilities can be substantially improved. (7 refs.)

118332 An extraction of information of individuality based on the sense of voice quality. M.Yokoyama (Dept. of Electrical Engng., Ritsumeikan Univ., Kyoto, Japan), K.Inoue.
Mem. Res. Inst. Sci. & Eng. Ritsumeikan Univ. (Japan), no.41, p.71-7 (1982).
Describes the extraction of the senses of the voice quality which characterize a similarity of speakers in speech, and of acoustic physical parameters which prescribe voice qualities. Experiments of similarity judgments of all possible combinations on speech samples (vowel /e/) by listeners are performed. Six commonly used terms that describe voice qualities are used as similarity judgments. A fundamental frequency and formants are utilized as acoustic parameters. From results of analyses based on the correlational method and the multidimensional scaling (MDS) technique for these experimental data, it became clear that the similarity sense of speakers correlates with not only 'pitch sense' but also other senses of the voice quality, and specified acoustic parameters contribute to the senses of the voice quality. (6 refs.)

118333 As to the volume indication of speech sounds—volume indicators for deaf persons. D.Mehnert (Humboldt Univ. Berlin, Berlin, Germany).
Nachrichtentech. Elektron. (Germany), vol.33, no.9, p.383-5 (1983). In German.
Deaf persons often have a speech volume width deviating from the standard. Either it is too small, or—as in most cases—too wide. This results in speech sounding unnatural and remaining unintelligible for the communication partner. After preliminary remarks as to the speech volume two volume indicators for the optical indication of sound level values are presented. Technical details are mentioned and experience in the school-practical trial stated. (7 refs.)

118334 Assistance in oral learning of a foreign language using a speech recognition system. M.T.Janot-Giorgetti, M.Lamotte (Univ. de Nancy I, Vandoeuvre-les-Nancy, France).
Rev. Phys. Appl. (France), vol.18, no.9, p.595-610 (Sept. 1983). In French.
A computerized system for assistance in oral learning of a foreign language is presented. In this system a speech recognition method has been implemented on a microprocessor. Mispronunciations are automatically detected among those previously memorized in the system for each word of a given lesson. Difficulties in phonetics and position of the stressed syllables which are typical of the spoken English language have been tested to determine the effectiveness of the system. (12 refs.)

43.75 MUSIC AND MUSICAL INSTRUMENTS

118335 Flexural vibration of truncated elliptical cone and Chinese chime bells. Cheng Tong, Zhen Da-Rui (Inst. of Acoustics, Acad. Sinica, Peking, China).
Acta Acust. (China), vol.8, no.3, p.129-34 (May 1983). In Chinese. [received: Oct. 1983]
The authors model the Chinese chime bell as a truncated elliptical cone. The flexural vibration of an elliptical cone is analysed for the fundamental modes of vibration of chime bells. An approximate expression for the frequency of the two tones of a chime bell is derived. (4 refs.)

118336 Comments on 'The quality of strings for guitars: an experimental study'. R.J.Hanson (Dept. of Phys., Univ. of Northern Iowa, Cedar Falls, IA, USA).
J. Sound & Vib. (GB), vol.90, no.2, p.283-5 (22 Sept. 1983).
Discusses several aspects of the paper by Dayan and Behar (see ibid., vol.64, p.421, 1979) on the quality of guitar strings. That paper reported the correlation of acoustical measurements (mainly sound levels and frequencies of the fundamental and overtones) with the subjective quality of 'goodness' of guitar strings. (1 ref.)

43.85 ACOUSTICAL MEASUREMENTS AND INSTRUMENTATION

(for acoustic noise measurement, see also 43.50; for photoacoustic spectroscopy, see 07.65)

118337 A microprocessor-controlled audiometer of the Bekesy type for high frequencies, and its use. J.M.Arnett,Jr., J.J.Knight (Inst. of Laryngology & Otology, Univ. of London, London, England).
Acoust. Lett. (GB), vol.6, no.12, p.172-7 (June 1983).
Work to date on hearing thresholds in the range 10-20 kHz has used either conventional pure tone or, alternatively, fixed frequency self-recording methods. To give more detailed information on the high frequency thresholds, a swept-frequency Bekesy type audiometer, with a pulsed tone presentation, has been developed. As the effect of ageing is a major factor in hearing sensitivity at high frequencies, knowledge of the variation of normal thresholds with age is fundamental to any diagnostic application. (7 refs.)

118338 Pulse compression acoustic microscopy at 750 MHz. M.Nikoonahad, G.Q.Yue, E.A.Ash (Dept. of Electronic & Electrical Engng., Univ. Coll. London, London, England).
Electron. Lett. (GB), vol.19, no.19, p.782-4 (15 Sept. 1983).
A pulse compression acoustic microscope working at a centre frequency of 750 MHz is reported. The pulse expansion and compression is achieved by SAW dispersive delay lines. The transmitted chirp has a bandwidth of 150 MHz and a dispersion of 1 MHz/ns. A processing gain in excess of 10 dB has been achieved. (3 refs.)

118339 Ultrasound imaging. M.Fink (Lab. d'Acoustique Moleculaire, Univ. Louis Pasteur, Strasbourg, France).
Rev. Phys. Appl. (France), vol.18, no.9, p.527-56 (Sept. 1983). In French.
Simultaneously to the development of new imaging techniques (X-ray scanner, NMR imaging, synthetic aperture radar...) spectacular progress in ultrasound imaging has been made in recent years. Following a summary of imaging ultrasound principles, the article reviews main attempts performed in this research area. An evaluation of the various ultrasound techniques is done in the fields of medical diagnosis, non-destructive testing and underwater imaging. After a comparison between these various techniques, the emphasis is put on the characteristics of ultrasound imaging techniques. The new area of echotomography is described. The use of sophisticated signal processing techniques enables this new approach in echography, which must lead soon to a quantitative imaging of acoustical parameters. (64 refs.)

118340 Voltage and current amplifiers in ultrasonic equipment. V.M.Geller, M.B.Gitis (All-Union Nondestructive Testing Res. Inst., Kishinev, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.84-7 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.7-11 (Feb. 1983). [received: Oct. 1983]
Aspects are considered in the choice of input conditions for a signal amplifier in a receiving transducer, including the noise immunity. (7 refs.)

Radiation field of a plane waveguide into an elastic space ..... See Entry 117165

Thermal wave piezoelectric and microphone detection for non-destructive evaluation: a comparison ..... See Entry 117171

Laser-piezoelectric-photoacoustic observation of the electrode surface ..... See Entry 117247

Conception and realization of a photoacoustic detector for in situ spectroscopy ..... See Entry 117248

Multiplex detection in a combined laser optoacoustic spectrometer-chromatograph ..... See Entry 117249

Information principles of active sonar detection ..... See Entry 118324

Noise measurement and cost efficiency analysis exemplified by the 'whispering tractor' ..... See Entry 118326

An ultraconic flowmeter—wave meter UMP-10 ..... See Entry 118695

Evaluation of the results of automatic ultrasonic tests and grading of heavy sheet with regard to specification using an EDV-system ..... See Entry 120531

Studies on defect indication in ultrasonic testing by the rear wall echo method ..... See Entry 120533

Resolution in depth of ultrasonic testers ..... See Entry 120534

Selecting the control reflectors for flaw detection in welded joints ..... See Entry 120552

Relation between the actual and nominal boundaries of an extended defect in ultrasonic examination of a thick sheet ..... See Entry 120559

Attenuation of ultrasound in steels with a homogeneous structure ..... See Entry 120560

Measuring procedure for the physical and mechanical characteristics of thin rods and wires using the ultrasonic resonance method ..... See Entry 120561

Special features of the ultrasonic inspection of purity of aluminum A9999 ..... See Entry 120563

Detectability of defects in inspection with ultrasonic inclined transducers made of organic glass and caprolon ..... See Entry 120564

Ultrasonic fractography of glassy polymers ..... See Entry 120589

Ultrasonic detection of free radicals decay in polyethyl methacrylate ..... See Entry 120621

Errors due to signal cutoff in the measurement of sound intensity or sound-pulse dose ..... See Entry 120956

Real time ultrasonic imaging with arrays ..... See Entry 120974

Diagnostic potential of magneto-photoacoustic spectroscopy . See Entry 120976

Photoacoustic spectra of natural apatites in the near ultraviolet and visible regions ..... See Entry 121214

43.88 TRANSDUCTION; DEVICES FOR THE GENERATION AND REPRODUCTION OF SOUND

118341 Microphone sensitivity calibration under high intensity sound. Zhang Ru-Wei, Zhang Bai-Ling (Inst. of Acoustics, Acad. Sinica, Peking, China).
Acta Acust. (China), vol.8, no.3, p.135-9 (May 1983). In Chinese. [received: Oct. 1983]
The change of sensitivity of the condenser microphones CH 16 and BK 4136 etc. are estimated and calibrated under the high intensity sound. The sensitivity of microphones as described above was calibrated by a high pressure microphone calibrator Type 4221: the range of sound pressure level was from 140 dB to 161.6 dB. In general, the maximum change of sensitivity for these microphones was less than 0.3 dB. As compared with the result of pistonphone calibration, the maximum difference was less than 0.4 dB, i.e. within the limits of experimental error. In addition, similar experiments were carried out under the high intensity sound from 168 dB to 173 dB and the same result was obtained. The experiment results were in agreement with the results of the theoretical analysis. The method has proved that microphone sensitivity calibrated by pistonphone can be used for the microphone intended for high intensity sound (below 170 dB). (2 refs.)

118342 Surface acoustic wave FM generators with large frequency deviation. L.N.Lutsyuk, A.A.Palamarchuk, A.T.Shostak.
Radioelectron. & Commun. Syst. (USA), vol.25, no.7, p.85-6 (1982). Translation of: *Izv. VUZ Radioelektron. (USSR)*, vol.25, no.7, p.78-9 (1982). [received: Oct. 1983]
Discusses how use of devices based on surface acoustic waves enables one, comparatively easily to design FM generators with a frequency modulation that does not vary with time, and which provide high deviation and high central-frequency stability. (5 refs.)

118343 The Y-parameter matrix of a surface wave filter with apodized transducers. A.N.Timoshenko.
Radioelectron. & Commun. Syst. (USA), vol.25, no.7, p.87-8 (1982). Translation of: *Izv. VUZ Radioelektron. (USSR)*, vol.25, no.7, p.80-1 (1982). [received: Oct. 1983]
The Y-parameter matrix of an ideal filter based on surface acoustic waves has been obtained. It holds for the case when the filter contains nonapodized interdigital transducers, i.e. when the surface waves excited by the transducers have a constant linear energy flux density along the front. Sometimes, in order to obtain the required amplitude-frequency characteristics of the surface acoustic wave filters, apodization of both interdigital transducers is employed. It therefore seems advisable to extend the matrix representation given to the case of the interaction of a surface acoustic wave that is nonuniform over the wavefront with apodized interdigital transducers. (6 refs.)

118344 Metal-insulator-semiconductor convolver. V.A.V'yun, A.A.Kreimer, I.B.Yakovkin (Inst. of Semiconductor Phys., Acad. of Sci., Novosibirsk, USSR).
Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.556-7 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1292-5 (Nov. 1982). [received: Sept. 1983]
One of the most promising nonlinear electroacoustic devices is the surface-acoustic-wave convolver. In the present experiments the authors studied a surface-acoustic-wave (SAW) convolver structure with a zinc oxide film on a silicon substrate. The zinc oxide films were deposited by cathode sputtering in a DC diode system. As substrates they used n-type silicon wafers with a resistivity of 4.5 Ω.cm (100) coated with a silicon dioxide layer 1000 Å thick. The authors used these structures to fabricate delay lines which operated in the band 140-160 MHz with an insertion loss of 26 dB without matching. The application of a static transverse field to the transducer region resulted in a modulation of the SAW excitation efficiency. As the voltage was varied from −1.5 to −10 V the SAW amplitude changed by 6 dB. 'Field' electrodes between the transducers transform this delay line into a metal-insulator-semiconductor convolver. (7 refs.)

Acoustic impulse generation by electric discharges ..... See Entry 118776

Metal carbonyl bond strengths: applications of photoacoustic calorimetry ..... See Entry 120651

44.00 HEAT FLOW, THERMAL AND THERMODYNAMIC PROCESSES

44.10 HEAT CONDUCTION (MODELS, PHENOMENOLOGICAL DESCRIPTION)

118345 Enhancement of diffusive transfer by periodic pulsation between Dirichlet and Neumann type boundary conditions. S.J.Putterman, R.Guibert (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Appl. Sci. Res. (Netherlands), vol.40, no.3, p.271-7 (1983).
A solution of the equation of heat conduction is computed for the case where the boundary condition alternates periodically between fixed temperature and fixed heat flow. This problem is equivalent to a highly nonlinear parametric oscillation. Applications to energy conservative and nondestructive heating are discussed. (6 refs.)

118346 Prediction of interfacial filler thickness for minimum thermal contact resistance. P.W.O'Callaghan, B.Snaith, S.D.Probert (Cranfield Inst. of Technol., Cranfield, England).
AIAA J. (USA), vol.21, no.9, p.1325-30 (Sept. 1983).
A theoretical optimization procedure to establish the appropriate filler thickness for minimizing thermal contact resistance between flat nonwavy surfaces is developed and demonstrated. The analysis is founded upon the assumption of ideal plastic asperity deformation at the interface formed between randomly rough surfaces separated by the softer filler material. Experimental measurements of the thermal contact resistance for various contacting assemblies are presented to verify the prediction. (12 refs.)

118347 The non-stationary temperature distribution in heated pipelines. W.Haubitzer (Inst. fur Elektrotech., Montanuniv. Leoben, Leoben, Austria).
ETZ Arch. (Germany), vol.5, no.8, p.257-60 (Aug. 1983). In German.
The non-stationary temperature distribution is calculated using the Laplace-transformation, assuming a constant coefficient of thermal conductivity but no particular ambient temperature distribution. The temperature distribution may be expressed by a double series which converges well. (2 refs.)

118348 Measurement of fusion boundary energy transport during arc welding. C.S.Landram (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.550-4 (Aug. 1983).
An experimental technique is presented to identify fusion boundary (liquid/solid interface) energy transport mechanisms during welding procedures. The gas-tungsten-arc spot-welding procedure, using a low melting point specimen material (lead), was chosen to demonstrate the methods. Vaporization energy losses were found to be important during the growth of the fusion boundary. Significant thermal convection was absent within the weld pool for applied currents less than about 100 A, and for such cases the location of the fusion boundary was found to be governed primarily by heat conduction. At the current levels of almost 300 A, significant weld pool convection was found to exist, especially at the (inner) stagnation point, causing a deeper penetration of the fusion boundary there. (18 refs.)

118349 A stochastic approach to thermal modeling applied to electrodischarge machining. S.M.Pandit, K.P.Rajurkar (Dept. of Mech. Engng., Michigan Technol. Univ., Houghton, MI, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.555-62 (Aug. 1983).
The usual method of making some simplifying assumptions and formulating thermal models that yield results confirmed by experiments does not work in many cases where the problem is complex and random. Electrodischarge machining (EDM) is such a process that is not only complicated and random but also physically little understood. The paper illustrates thermal modeling of this process with the help of a recently developed stochastic methodology called data dependent systems (DDS). An equation to the melting isothermal curve is defined from the DDS (stochastic empirical) model obtained from readily measurable surface profiles of actual machined surfaces created by the random superposition of electrical discharges. This equation of the melting isothermal curve is then combined with the heat conduction equation, under rather realistic and intuitively obvious assumptions, to develop a transient temperature distribution. The form of this (hybrid) thermal model is mathematically much simpler and yet its predictions are much closer to the experimental results, compared to the complicated models proposed in the literature. (25 refs.)

118350 The one-dimensional analysis of fin assembly heat transfer. M.Manzoor, D.B.Ingham (Dept. of Appl. Math. Studies, Univ. of Leeds, Leeds, England), P.J.Heggs.
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.646-51 (Aug. 1983).
The design of finned surfaces is conventionally performed in two stages. First the fin efficiency is determined by simultaneously analyzing the conductive heat flow within the fin, and the convective heat dissipation from the surface of the fin. Then, the effects of the thermal interaction between the supporting interface and the fins and the convective heat exchange at the plain side of the supporting interface are incorporated by employing a technique based on electric circuit theory. In this study, it is shown that this technique in fact has a mathematically rigorous foundation. It is also shown that, for design purposes, there is a far superior alternative to the fin efficiency. (16 refs.)

118351 Heat conduction in anisotropic wedge and elliptic cylinders. S.C.Huang (Dept. of Mech. Engng., Southern Univ., Baton Rouge, LA, USA), Y.P.Chang.
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.674-7 (Aug. 1983).
Presents the analytical solution of heat conduction in a wedge and an elliptic cylinder of an anisotropic medium which is homogeneous in rectangular coordinates. Both steady and unsteady states are considered. By a number of coordinate transformations, these problems can be solved by many standard methods. Only the results obtained by the separation of variables are shown. The transformed equations are also useful for numerical solution. (15 refs.)

118352 Conductive heat transfer between eccentric cylinders with boundary conditions of the third kind. R.F.DiFelice,Jr. (General Electric Co., Philadelphia, PA, USA), H.H.Bau.
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.678-80 (Aug. 1983).
The authors consider conductive heat transfer in an eccentric annulus, between a buried pipe and the surface of a semi-infinite medium, and between two pipes embedded in an infinite medium. Each of these geometrical configurations is germane to various industrial problems, such as heat losses through eccentric insulations and heat losses from buried pipes. (6 refs.)

118353 Temperature waves in materials with thermal memory. A.G.Shashkov, S.Yu.Yanovskii.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.79-82 (1983). In Russian.
A steady-state process in one-dimensional isotropic media has been considered in terms of the heat conduction theory with allowance for the thermal Gurtin-Pypkin memory. The decay coefficient and wave phase velocity as a function of the frequency and relaxation parameters of a heat flux and internal energy have been obtained and analyzed. (7 refs.)

118354 A method for the solution of the equations of a viscous heat-conducting gas. V.I.Pinchukov.
Zh. Vychisl. Mat. & Mat. Fiz. (USSR), vol.23, no.4, p.901-9 (July-Aug. 1983). In Russian. English translation in: *USSR Comput. Math. & Math. Phys. (GB)*
A conditionless difference scheme is proposed for a numerical solution of the equations of a viscous compressible heat-conducting gas, written in arbitrary curvilinear coordinates, having a second order approximation in smooth solutions and monotonic in regions with large gradients. Results of test calculations are presented, including the calculation of accurate solutions, obtained by the introduction of the original terms into the equations. (17 refs.) *A.G.C.*

118355 Nonlinear boundary value problem for the steady-state one-dimensional heat conduction equation. P.Fernandes, R.Parodi.
Report INFN/TC-83/10, Ist. Naz. Fis. Nucl., Genoa, Italy (6 May 1983), 6 pp.
The numerical solution is discussed of a two-point boundary value problem, arising in RF superconductivity, for the steady-state one-dimensional heat conduction equation with thermal conductivity depending on temperature and boundary conditions nonlinearly involving temperature and heat flux. The numerical method employed attains a great computational saving in comparison with standard ones by taking advantage of the particular features of the problem and can be likewise applied to other problems. The general mathematical form a problem must have for being solved by the aforementioned method is then laid down. (4 refs.)

Unsteady state heat transfer in superinsulated liquid nitrogen dewars .... See Entry 117187

Heat transfer and temperature profile studies in cylindrical cryogenic glass dewars .... See Entry 117188

44.25 CONVECTIVE AND CONSTRAINED HEAT TRANSFER

(see also 47.25Q Convection and heat transfer)

The one-dimensional analysis of fin assembly heat transfer .. See Entry 118350

Heat transfer behavior of frozen soils .... See Entry 118362

44.30 HEAT TRANSFER IN INHOMOGENEOUS MEDIA AND THROUGH INTERFACES

118356 Continuity of the temperature in the two-phase Stefan problem. L.A.Caffarelli, L.C.Evans (School of Maths., Univ. of Minnesota, Minneapolis, MN, USA).
Arch. Ration. Mech. & Anal. (Germany), vol.81, no.3, p.199-220 (1983).
The classical two-phase Stefan problem, a model for ice-water melting, gives rise to a singular, nonlinear partial differential equation which admits a unique weak solution. Here the authors prove that this solution, and therefore the temperature in the Stefan problem, are continuous. (8 refs.)

Method of calculating electromagnetic and thermal fields in electrically conducting bodies during induction heating .... See Entry 118033

44.40 RADIATIVE HEAT TRANSFER

118357 Experimental determination of nocturnal radiation. J.Doria, J.I.Ajona, M.R.Heras, A.L.Tovar (Facultad de Ciencias Fisicas, Univ. Complutense, Madrid, Spain).
An. Fis. Ser. B (Spain), vol.79, no.2, p.188-93 (May-Aug. 1983). In Spanish. [received: Oct. 1983]
The radiative heat transfer from cultivated soils are deeply modified when covered with a transparent material. The authors find out the relation between the optical spectra of the covers and the thermal situation they induce on the surface, as well as the energetic losses produced by radiative cooling to the outer space from the cover. (5 refs.)

118358 Experimental determination of the transference parameters of a nonconvecting solar pond. M.C.de Andres, J.Doria (Facultad de Ciencias Fisicas, Univ. Complutense, Madrid, Spain).
An. Fis. Ser. B (Spain), vol.79, no.2, p.194-201 (May-Aug. 1983). [received: Oct. 1983]
An experimental prototype of nonconvecting solar pond at laboratory scale has been developed for the accurate determination of the heat transfer parameters. These are essential for the resolution of solar ponds heat transfer equations. As these parameters are obtained from the energetic balances in the nonconvecting zones, in local stationary state, it has been necessary to control heat transfer by means of heating bands. (4 refs.)

118359 A line-by-line calculation of low-resolution radiative properties of CO_2-CO-transparent nonisothermal gases mixtures up to 3000K. J.Taine (Groupe de Recherches Thermiques, Ecole Centrale des Arts et Manufactures, Chatenay-Malabry, France).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.4, p.371-9 (Oct. 1983).
Low-resolution radiative properties (absorptivities, transmissivities, intensities) of nonisothermal or inhomogeneous gas mixtures at high temperatures, suitable for radiative heat transfer applications (e.g. in combustion) are obtained from a line-by-line calculation, using recently published high-resolution spectroscopic data at 296K given by AFGL. It is shown that absorptivities obtained for isothermal mixtures of CO_2, CO, N_2 (and sometimes H_2O) agree with the corresponding measured spectra. (43 refs.)

118360 Method of solution of radiative conductive heat transfer equations. A.I.Zuev, N.G.Karlykhanov.
Zh. Vychisl. Mat. & Mat. Fiz. (USSR), vol.23, no.4, p.910-21 (July-Aug. 1983). In Russian. English translation in: *USSR Comput. Math. & Math. Phys. (GB)*
A method is examined for the solution of a problem of radiative-conductive energy transfer in a nonstationary multigroup kinetic approximation for a description of thermal radiation. In the framework of the proposed method a combinational method of solution is constructed for the case when in various parts of the region determinations of the original equations lead to different approximations. The effectiveness of the proposed method is illustrated by solving model problems. (15 refs.) *A.G.C.*

Unsteady state heat transfer in superinsulated liquid nitrogen dewars .... See Entry 117187

44.50 THERMAL PROPERTIES OF MATTER (PHENOMENOLOGY, EXPERIMENTAL TECHNIQUES)

(see also 07.20 Thermal instruments and techniques)

118361 The accuracy of heat conductance measurements with cylindrical samples. W.Jablonski, B.Wnetrzewski (Politechn. Warszawska, Warsaw, Poland).
Szklo & Ceram. (Poland), vol.34, no.4, p.136-8 (July-Aug. 1983). In Polish.
Different sources of error are consecutively discussed. Especially important is the exact location of the thermocouples within the sample. The results of the discussion may have practical value for measurements of heat conductance with cylindrical samples. (6 refs.)

118362 Heat transfer behavior of frozen soils. H.Inaba (Dept. of Mech. Engng., Kitami Inst. of Technol., Hokkaido, Japan).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.680-3 (Aug. 1983).
The thermal properties and unfrozen water content of various soils were examined experimentally by the transient probe method and calorimetric technique. It could be seen that measured values of effective thermal conductivity and specific heat show a strong dependence on the temperature, initial moisture content, and grain size of soil in the temperature range of $T=0$°C to -10°C. Unfrozen water content of the frozen soil increases as the grain size of soil decreases. The peculiar behavior for fine grain-sized soil of decreasing effective thermal conductivity with decreasing temperature, T, below 0°C was observed for large initial moisture content $w=30$-40 percent. (12 refs.)

A method for analysing the heat conductivity of ceramic porous materials .... See Entry 117172

Thermal impedance of pressed contacts at temperatures below 4K .... See Entry 117184

Enhancement of diffusive transfer by periodic pulsation between Dirichlet and Neumann type boundary conditions .... See Entry 118345

A European heat-pipe experiment on the second flight of Space-Shuttle 'Challenger' .... See Entry 118364

44.60 THERMODYNAMIC PROCESSES (PHENOMENOLOGY, EXPERIMENTAL TECHNIQUES)

(see also 05.70 Thermodynamics, 07.20 Thermal instruments and techniques)

118363 Pool boiling of drag-reducing polymer solutions. N.M.Ruai, S.I.Abdel-Khalik (Dept. of Nuclear Engng. Dept., Univ. of Wisconsin, Madison, WI, USA).
Appl. Sci. Res. (Netherlands), vol.40, no.3, p.209-22 (1983).
The effect of drag-reducing polymeric additives on the critical heat flux and minimum film boiling temperature in subcooled pool boiling of water has been experimentally examined. Three water-soluble polymers, viz. a polyethylene oxide (Aldrich No.18946-4), a poly-acrylamide (Separan AP-30), and a galactomannan polysaccharide (Galactasol-211) have been examined at concentrations of 10, 50 and 100 wppm. The experiment is performed by quenching a hot brass sphere in an isothermal pool of the fluid to be examined and obtaining the corresponding boiling curve. The experiments have been conducted at atmospheric pressure with a pool temperature of 90°C. The results show that the critical heat flux increases by more than 50% while the minimum film boiling temperature increases by more than 110°C when concentrations of 100 wppm of polyox or guar gum are used. For separan solutions, the critical heat flux and minimum film boiling temperatures are lower than those for water and go through a minimum at a concentration of ~ 1 wppm; the maximum reductions are about 73% and 34°C respectively. (12 refs.)

118364 A European heat-pipe experiment on the second flight of Space-Shuttle 'Challenger'. C.J.Savage (Dept. of Spacecraft Technol., ESTEC, Noordwijk, Netherlands).
ESA Bull. (France), no.35, p.76-81 (Aug. 1983).
The second flight of 'Challenger' caried a European heat-pipe experiment designed to measure the performance of constant-conductance heat pipes, variable-conductance heat pipes and diodes over a 24 h period. The experiment, sponsored jointly by ESA and the German Ministry of Science and Technology (BMFT), formed part of the first payload for the German Shuttle Pallet Satellite (SPAS-01). (no refs.)

118365 Critical heat flux for uniformly heated vertical channels with low ratios of heated length to heated equivalent diameter. Y.Katto, A.Sanada (Dept. of Marine Engng., Univ. of Tokyo, Tokyo, Japan).
J. Fac. Eng. Univ. Tokyo Ser. B (Japan), vol.37, no.1, p.1-15 (March 1983). [received: Oct. 1983]
When the ratio of heated length l to heated equivalent diameter d_{he} is reduced excessively for a uniformly heated channel, critical heat flux (CHF) may possibly change its character from that of a channel flow toward that of a heated surface in a parallel flow. The aim of this study is to clarify phenomenological outlines of this problem. In order to observe CHF under intermediate conditions between the channel and the parallel flow, experiments are made for flow boiling of R-113 in internally heated annuli of low l/d_{he} ratios with comparatively high mass velocities. Then, the data obtained are analyzed together with the existing data of CHF for low l/d_{he} ratios in the case of high mass velocities, from which tentative criteria are derived for the occurrence of channel flow CHF and parallel flow CHF. Finally, the existing data obtained for low l/d_{he} ratios in the case of low mass velocities are also analyzed clarifying a special character of CHF under these conditions. (25 refs.)

118366 Evaporation of water from a horizontal surface by natural convection. E.M.Sparrow, G.K.Kratz, M.J.Schuerger (Dept. of Mech. Engng., Univ. of Minnesota, Minneapolis, MN, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.469-75 (Aug. 1983).
Experiments were performed to measure the mass transfer coefficients for natural convection evaporation from a horizontal water layer. Owing to the latent heat requirements of the evaporation process, the temperature of the water layer is depressed relative to the ambient temperature. This gives rise to a buoyancy which overpowers the oppositely directed buoyancy associated with the concentration gradient of the water vapor. The experiments encompassed two orders of magnitude in the Rayleigh number and, in addition, the effects of two geometrical parameters were investigated. One of these is the size of a horizontal annular frame which surrounds the water containment pan, while the other is the step caused by the difference between the water level and the height of the pan sidewall. Both the presence of the frame and of the step decrease the mass transfer coefficient. Narrow frames give rise to a sharp decrease, but further enlargements of frame size have little additional effect. The step-height effect was found to be independent of both the Rayleigh number and the frame size, enabling a universal correlation. Furthermore, for all of the investigated steps and frames, $Sh \sim Ra^{0.205}$. (14 refs.)

118367 Transient response of gas-to-gas crossflow heat exchangers with neither gas mixed. F.E.Romie.
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.563-70 (Aug. 1983).
The transient mixed mean temperatures of the two gases leaving a crossflow heat exchanger are found for a unit step increase in the entrance temperature of either gas. The temperature responses are given in graphical form for the range of parameters: Ntu from 1 to 8, capacity rate ratio from 0.6 to 1.67, and conductance ratio from 0.5 to 2.0. The solutions are found using the Laplace transform method and apply to single-pass crossflow exchangers with neither gas mixed. (11 refs.)

118368 Analysis of mechanical-draught counterflow air/water cooling towers. J.W.Sutherland (Agricultural Engng. Group, CSIRO, Highett, Victoria, Australia).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.576-83 (Aug. 1983).
Compares an accurate analysis of mechanical draught counterflow cooling towers, including water loss by evaporation with the approximate common method based on enthalpy driving force developed by Merkel in 1925. Computer programs were developed for both the accurate analysis and the approximate analysis. Substantial underestimates of tower volume of from 5 to 15 percent are obtained when the approximate analysis is used, indicating the possibility of quite serious consequences as far as cooling tower design is concerned. Computer predictions of cooling tower integral are shown to compare well with published values. (27 refs.)

118369 Mean temperature difference in multipass crossflow. A.Pignotti, G.O.Cordero (Techint SA, Buenos Aires, Argentina).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.584-91 (Aug. 1983).
A procedure is developed to obtain analytical expressions for the mean temperature difference in crossflow heat exchangers with arbitrary number of passes and rows per pass. The influence of air mixing, along with different flow arrangements for the tube fluid between passes, is analyzed, both in co- and counter-crossflow. (11 refs.)

118370 Mean temperature difference charts for air coolers. A.Pignotti, G.O.Cordero (Techint SA, Buenos Aires, Argentina).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.592-7 (Aug. 1983).
Computer generated graphs are presented for the mean temperature difference in typical air cooler configurations, covering the combinations of numbers of passes and rows per pass of industrial interest. Two sets of independent variables are included in the graphs: the conventional one (heat capacity water ratio and cold fluid effectiveness), and the one required in an optimization technique of widespread use (hot fluid effectiveness and the number of heat transfer units). Flow arrangements with side-by-side and over-and-under passes, frequently found in actual practice, are discussed through examples. (10 refs.)

118371 Boiling heat transfer with Freon 11 (R11) in brazed aluminum, plate-fin heat exchangers. J.M.Robertson, P.C.Lovegrove (Engng. Sci. Div., AERE, Harwell, England).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.605-10 (Aug. 1983).
The results of laboratory experiments with Freon 11 (R11) flowing in an electrically heated, serrated-fin test section to measure local boiling coefficients over a wide range of vapor quality, with mass fluxes up to 150 kg/m^2 s, heat fluxes to 4 kW/m^2, and pressure from 3-7 bar, are reported. These low mass and heat fluxes reflect the industrial process application of these heat exchangers where exceedingly small temperature differences may exist between streams. Results are compared with the very similar boiling characteristics previously reported elsewhere for the same test section, with liquid nitrogen as a test fluid under comparable flow conditions. A simple method using the Reynolds number of the total flow regarded as a liquid has been used to correlate boiling heat transfer coefficients with quality for both fluids. The use of a liquid-film flow model to produce a nondimensional correlation connecting the Nusselt, Reynolds, and Prandtl numbers of the film is discussed. (18 refs.)

118372 A numerical finite difference method for performance evaluation of a periodic-flow heat exchanger. Chung-Hsiung Li (Dept. of Engng. Technol., C-E Air Preheater Co., Wellsville, NY, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.611-17 (Aug. 1983).
A numerical finite difference method is presented for calculating the fluid and metal temperature distributions for the periodic-flow type heat exchanger, accounting for the effect of heat conduction in the wall in the direction of fluid flow. Unlike previous solution techniques that use the Gauss-Seidel method based on a single element calculation, the method presented uses a column of elements to compute the fluids and metal temperature distributions, and it allows variable or constant thermal properties (specific heats, densities, heat transfer coefficients, and thermal conductivities). Nonuniform mass flow rates and a nonuniform grid spacing may be employed. The present method reduces the computational time required for convergence and improves the numerical stability while allowing an arbitrary metal temperature distribution as a starting case. After qualifying the numerical method, illustrative results are presented for counterflow and parallel flow rotary regenerators with three different surfaces in the flow direction and variable fluid and material properties. (13 refs.)

118373 Surface microfouling during the induction period. R.E.Baier, A.E.Meyer, V.A.DePalma, R.W.King, M.S.Fornalik (Advanced Technol. Center, Calspan Corp., Buffalo, NY, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.618-25 (Aug. 1983).
The time during which newly installed or cleaned heat transfer surfaces remain free of fouling deposits thick enough to diminish heat transfer coefficients or energy efficiency is often called the 'induction period', a term disguising lack of knowledge of the microfouling events actually occurring. Using novel flow cells to conduct water of fresh, brackish, and oceanic quality, natural and treated with antifouling chemicals, over test surfaces of different clean and coated metals, it has been observed that the initial pattern of fouling deposits is remarkably similar in all circumstances. Rapid adsorption of protein-dominated films is followed by attachment of rodlike bacteria, bacterial exudation, colonization by a second wave of prosthecate microorganisms, additional secretion, and growth of debris-trapping filamentous appendages. Although inappropriate to extrapolate the noted rates of these processes to in-plant heat exchangers at present, this sequence of microfouling events seems universal enough to characterize the induction period of all water-side biofouling phenomena. (13 refs.)

118374 Experimental observations of the microlayer in vapor bubble growth on a heated solid. L.D.Koffman, M.S.Plesset (Dept. of Engng. Sci., California Inst. of Technol., Pasadena, CA, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.625-32 (Aug. 1983).
Experimental measurements of microlayer formation and of the time history of microlayer thickness change have been obtained for nucleate boiling of water and ethanol. These detailed measurements were obtained using laser interferometry combined with high-speed cinematography. The measurement technique is discussed in detail with emphasis on the difficulties encountered in interpretation of the fringe patterns. The measurements for water can be reasonably applied to the data of Gunther and Kreith (1950), in which case it is concluded that microlayer evaporation alone cannot account for the increased heat transfer rates observed in highly subcooled nucleate boiling. It appears that microconvection must play at least an equal role. (25 refs.)

118375 Measurement of condensation curves for dropwise condensation of steam at atmospheric pressure. I.Tanasawa (Inst. of Industrial Sci., Univ. of Tokyo, Tokyo, Japan), Y.Utaka.
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.633-8 (Aug. 1983).
Condensation curves for dropwise condensation of steam at atmospheric pressure were measured for the range of surface subcooling between 0.5 and 180K using a heat transfer block having a concave spherical condensing surface. The heat transfer coefficient remained constant with the increase of surface subcooling up to about 10K, and then it decreased. The maximum heat fluxes were found to be between 9.3 and 12.2 MW/m^2. Dropwise condensation could be observed at a surface subcooling larger than the one corresponding to the peak heat flux, but shortly the mode of condensation shifted to pseudo-film or on-ice condensation. (6 refs.)

118376 Cauchy method for solidification interface shape during continuous casting. R.Siegel (Lewis Res. Center, NASA, Cleveland, OH, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.667-71 (Aug. 1983).
In 1978, an analysis was made to obtain the two-dimensional interface shape of a slab ingot being cast continuously by withdrawing it from a mold. A complexity in this type of problem is that the interface shape depends on the heat transfer conditions, and hence when solving for the heat conduction within the ingot the region shape must be determined simultaneously as part of the analysis. A conformal mapping method was used, and this yielded an exact solution for the interface shape. The shape was found to depend on a single parameter combining the casting velocity, width of the ingot, and the temperature depression of the cooled sides of the ingot below the solidification temperature. An alternative method for solving this type of problem is presented by the author. It is more compact than the conformal mapping method, and may be useful for other similar problems. (4 refs.)

118377 Experimental study of solidification heat transfer in an open rectangular cavity. C.J.Ho, R.Viskanta (School of Mech. Engng., Purdue Univ., West Lafayette, IN, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.671-3 (Aug. 1983).
Describes solidification heat transfer experiments which were performed in a rectangular, two-dimensional, open cavity cooled from the vertical sides and the bottom. The focus in the paper is on the evolution of the solidification front and correlation of the frozen volume fraction of the phase change material with dimensionless time. (11 refs.)

118378 Heat transfer through thin films: approximate analysis and determination of effective heat transfer coefficient. L.E.Bobisud (Univ. of Idaho, Moscow, ID, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.673-4 (Aug. 1983).
The transfer of heat through the surface of a material is involved in many engineering problems, for example, the determination of the temperature distribution in a cooling fin. In practical situations the surface is often overlaid with a coating of another substance—scale, tarnish, oil, paint, etc.—possessing properties different from those of the underlying material and changing the heat transfer characteristics of the composite. Typically, this layer is both thin and a relatively poor conductor of heat. Although one can analyze the full problem of heat transfer through the base material, through the thin layer, and from the surface of this layer, such an analysis is more difficult than that involved in the textbook case of no surface layer. The author shows how a related problem whose solution approximates the desired solution can be deduced when the surface layer is thin and poorly conducting, as is frequently the case. Low-order correction terms are also obtained. (2 refs.)

Measurement of fusion boundary energy transport during arc welding ....See Entry 118348

Heat transfer from a heated pool to a melting miscible substrate ....See Entry 118591

44.90 OTHER TOPICS IN HEAT FLOW, THERMAL AND THERMODYNAMIC PROCESSES

118379 Temperature on a spherical surface with internal heat liberation and jet streamline flow. L.K.Vukovich, V.I.Lelkov, A.V.Nikolaev, S.S.Timar, N.V.Tkach.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.808-11 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR)*, vol.23, no.6, p.80-3 (Nov.-Dec. 1982). [received: Sept. 1983]
At present metal alloys and nonmetallic materials with lower thermal conductivity are finding application for the manufacture of shells. In addition their thermal conductivity is lowered (λ_m) as a result of thermal aging of the materials. In this connection an investigation of the effect of the thermal conductivity of the shell material on nonuniformity of the temperature in it is of interest for possibly a larger range of variation of λ_m. The effect of the geometrical characteristics, the thermal conductivity of the shell material, and the heat liberation power on nonuniformity of the temperatures in the shell is simply investigated with a single sphere. (4 refs.)

46.00 MECHANICS, ELASTICITY, RHEOLOGY

46.10 MECHANICS OF DISCRETE SYSTEMS

(see also 03.20 General mathematical aspects)

118380 The Idealized Structural Unit Method and its application to deep girder structures. Y.Ueda (Welding Res. Inst., Osaka Univ., Osaka, Japan), S.M.H.Rashed.

Comput. & Struct. (GB), vol.18, no.2, p.277-93 (1984).

An efficient method of analysis of nonlinear behavior until collapse of large size redundant structures is presented. The method is named as The 'Idealized Structural Unit Method'. In this method the structure is divided into the biggest possible 'Structural Units' whose geometric and material nonlinear behaviour can be idealized and described in a concise analytical-numerical form. The structure is reassembled and load is applied incrementally until ultimate strength is attained. In this method, modeling is an obvious operation of dividing the structure into its actual structural units. This eliminates the effort required for the choice of type of element or size of mesh as in the finite element method. The number of structural units and overall degrees of freedom required for the analysis of a structure by this method are less in order than the number of elements and overall degrees of freedom required to analyze the same structure by the FEM. Costs of computer and data preparation may be drastically reduced. (25 refs.)

118381 Motion of a material point under the action of a travelling sinusoidal wave. A.M.Tokar, A.F.Ulitko.

Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.50-2 (1983). In Ukrainian.

A differential equation is presented for material particle motion under the effect of an elastic travelling wave. One of the possible cases of motion is studied, namely, when the particle is given (at an average) ordered motion along the travelling wave propagation. (5 refs.)

118382 The response of multidegree-of-freedom systems with quadratic non-linearities to a harmonic parametric resonance. A.H.Nayfeh (Dept. of Engng. Sci. & Mech., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).

J. Sound & Vib. (GB), vol.90, no.2, p.237-44 (22 Sept. 1983).

An analysis is presented of the response of multidegree-of-freedom systems with quadratic non-linearities to a harmonic parametric excitation in the presence of an internal resonance of the combination type $\omega_3 \approx \omega_2 + \omega_1$, where the ω_n are the linear natural frequencies of the systems. In the case of a fundamental resonance of the third mode, one can identify two critical values ζ_1 and ζ_2, where $\zeta_2 \geq \zeta_1$, of the amplitude F of the excitation. The value $F=\zeta_2$ corresponds to the transition from stable to unstable solutions. When $F<\zeta_1$, the motion decays to zero according to both linear and non-linear theories. When $F>\zeta_2$, the motion grows exponentially with time according to the linear theory but the non-linearity limits the motion to a finite amplitude steady state. The amplitude of the third mode, which is directly excited, is independent of F, whereas the amplitudes of the first and second modes, which are indirectly excited through the internal resonance, are functions of F. When $\zeta_1 \leq F \leq \zeta_2$, the motion decays or achieves a finite amplitude steady state depending on the initial conditions according to the non-linear theory, whereas it decays to zero according to the linear theory. This is an example of subcritical instability. In the case of a fundamental resonance of either the first or second mode, the trivial response is the only possible steady state. When $F \leq \zeta_2$, the motion decays to zero according to both linear and non-linear theories. When $F>\zeta_2$, the motion grows exponentially with time according to the linear theory but it is aperiodic according to the non-linear theory. (11 refs.)

118383 Optimization of Euler turning of nonlinear elastic object. A.E.Zakrzhevskii.

Mech. Solids (USA), vol.17, no.6, p.1-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.3-9 (1982). [received: Oct. 1983]

One form of programmed motion of a free rigid body, that is of interest for technical applications, is the mode of reorientation in inertial space. For both absolutely rigid and elastic bodies, this mode can be effected either by three successive turns by certain angles about axes that are rigidly attached to the undeformed body, or by one turn about the axis of equivalent rotation (Euler axis) which is fixed in inertial space and attached to the body. A solution is offered to the problem of optimizing the control of Euler turning of a nonlinear elastic object on the basis of the requirement of reducing the orientation noise and dynamic overloads that act on the elastic elements. (4 refs.)

118384 Stationary motion of a gyrostat with deformable plates and its stability in a Newtonian central force field. M.K.Nabiullin.

Mech. Solids (USA), vol.17, no.6, p.7-11 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.10-14 (1982). [received: Oct. 1983]

Using Lyapunov's direct method and previous theorems, on the basis of the idea of introducing the integral characteristics of motion of continuous media proposed in investigating problems of stability of motion of complex systems in relation to part of the variables, the author obtains and analyzes sufficient stability conditions for a family of relative equilibrium positions of a mechanical system consisting of a gyrostat and one pair of rectangular elastic plates that are symmetrically clamped in its housing. It is assumed that the center of mass of the system moves along a Keplerian circular orbit in a Newtonian central force field. (19 refs.)

118385 Determination of the orientation of the instrument trihedron using angle information. A.I.Tkachenko.

Mech. Solids (USA), vol.17, no.6, p.12-18 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.15-21 (1982). [received: Oct. 1983]

It is assumed that two right orthogonal trihedrons, whose mutual position is not known, are associated with a moving nondeformable object. The projections of the absolute angular velocity of the object onto the axes of the first (instrument) trihedron, and the kinematic parameters characterizing the position of the second associated trihedron relative to the specified inertial coordinate trihedron, are measured. By the vector matching method the author solves the problem of determining the orientation of the first associated trihedron relative to the inertial one. An important aspect of the proposed solution of this problem is the calculation of the vector parts of the quaternions characterizing the change in orientation of the object during two successive time intervals. (8 refs.)

118386 Suppression of plane vibrations of a platform using unbalanced suppressors. V.I.Babitskii, V.Sh.Burd.

Mech. Solids (USA), vol.17, no.6, p.25-9 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.29-33 (1982). [received: Oct. 1983]

Examines the possibilities for dynamic suppression of vibrations of an object by attaching two unbalanced masses to it. The authors seek to determine the alignment conditions for the unbalanced suppressors. (2 refs.)

118387 On the analysis of the force characteristics of the suspension of a cryogenic gyroscope. V.F.Zhuravlev, V.M.Rudenko.

Mech. Solids (USA), vol.18, no.1, p.7-13 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.18, no.1, p.9-15 (1983).

The authors propose an approximate calculation procedure for the force characteristics of the suspension of a cryogenic gyroscope, that yields the final formulas for the forces and stiffnesses of the suspension in the case of supporting coils or arbitrary (not necessarily circular) shape. The approach makes it possible to deal with problems of optimizing the shape and parameters of the coils of the suspension, as well as to make comparative analyses of different arrangements. The calculation method is an asymptotic one; the authors specify the limiting situation such that, as it is approached, the computational error tends to zero. For the particular case of a ring-shaped circuit with a current, the authors give upper and lower bounds for the relative error in determining the restoring force. (6 refs.)

118388 Kinematic control of the motion of a vessel with an ideal heavy fluid. L.D.Akulenko.

Mech. Solids (USA), vol.18, no.1, p.34-41 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.18, no.1, p.39-46 (1983).

The author investigates the plane problem of control of motion of a rigid rectangular vessel containing an ideal heavy fluid with a free surface. The relative motion of the fluid is described within the framework of the linear model of infinitely small waves. The author requires that the vessel execute prescribed motions at the end of the control process, and that there is no relative oscillation of the fluid. The author obtains approximate solutions that lead to simple control laws. The problem is of interest in controlling the motion of such entities as tankers, tanks and cisterns, and so forth. (12 refs.)

118389 Dynamics of soft braking systems. S.M.Belotserkovskii, I.V.Dneprov, A.T.Ponomarev, O.V.Rysev.

Mech. Solids (USA), vol.18, no.1, p.42-9 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.18, no.1, p.47-54 (1983).

Soft braking systems (parachutes) with various pattern geometries are extensively employed in aviation and space engineering. The process of opening (filling) and of motion of the load on the open parachute are important stages in the operation of such systems. In the filling process, the parachute is acted upon by the maximum aerodynamic loads, these being used as the basis for strength calculations for the structure. A feature of soft braking systems is that they constitute poorly streamlined surfaces, for which flow with separation is realized, and they take up only tensile loads. They display considerable displacements of the surface points of the canopy while the normal components of the velocity of the surface points are comparable to that of the primary flow. Problems of interaction between the load/parachute system and the flow reduce to investigation of a problem of aeroelasticity based on the apparatus of nonlinear aerodynamics and the theory of soft shells, which can be handled using modern computers. The authors study the problem in question using an approach that is based on a synthesis of numerical methods of nonlinear aerodynamics and elasticity theory, that involves successive solution of the equations of nonstationary nonlinear aerodynamics, generalized nonlinear elastic equations of Rakhmatulin type, and the equations of the dynamics of motion of a parachute and load. (7 refs.)

118390 An axisymmetric problem for a solid cylinder of finite length with weight. B.L.Abramyan.

Mech. Solids (USA), vol.18, no.1, p.50-6 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.18, no.1, p.55-62 (1983).

The author considers an axisymmetric problem for a solid cylinder of finite length acted upon by its own weight, in which the cylinder is attached on its lateral surface, while the bases of the cylinder are stress-free. The author reduces the solution of the problem to an infinite regular system of linear algebraic equations, and considers a numerical example. (9 refs.)

46.20 CONTINUUM MECHANICS

(see also 03.40 General mathematical aspects)

118391 Optimum design of plano-milling machine structure using finite element analysis. G.V.Ramana (Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA), S.S.Rao.

Comput. & Struct. (GB), vol.18, no.2, p.247-53 (1984).

The problem of optimum design of plano-milling machine structure is formulated as a nonlinear mathematical programming problem with the objective of minimizing the structural weight. The plano-milling machine structure is idealized with triangular plate elements and three dimensional frame elements based on finite element displacement method. Constraints are placed on static deflections and principal stresses in the problem formulation. The optimization problem is solved by using an interior penalty function method in which the Davidon-Fletcher-Powell variable metric unconstrained minimization technique and cubic interpolation method of one dimensional search are employed. A numerical example is presented for demonstrating the effectiveness of the procedure outlined. The results of sensitivity analysis conducted with respect to design variables and fixed parameters about the optimum point are also reported. (7 refs.)

118392 An axisymmetric Neumann potential problem for the circular annulus. E.N.Mastrojannis, T.Mura, L.M.Keer (Dept. of Civil Engng., Northwestern Univ., Evanston, IL, USA).

Comput. & Struct. (GB), vol.18, no.2, p.365-8 (1984).

The authors consider an axisymmetric three-part mixed boundary value problem wherein a Neumann condition is prescribed over a plane circular annulus and over the remainder of the plane of the annulus Dirichlet conditions are imposed. The problem is reduced to a problem of solving an infinite system of algebraic equations. Expressions are derived for the quantities of interest and some numerical results are given. (6 refs.)

118393 On a problem of structural dynamics. C.Cubeddu (Math. Inst., Univ. of Cagliari, Cagliari, Italy).

J. Mec. Theor. & Appl. (France), vol.2, no.4, p.559-66 (1983).

The equivalent static forces induced by earthquakes in shear-type frame structures can be expressed in a simplified form. It is shown that the structural response to an earthquake cannot, generally speaking, be represented just by the first three modes of vibration, as currently stipulated by the Italian Seismic Code. (7 refs.)

118394 Numerical plastic shakedown analysis of plates and shells of revolution by equilibrium finite elements. P.Morelle, Nguyen Dang Hung (Univ. de Liege, Liege, Belgium).
J. Mec. Theor. & Appl. (France), vol.2, no.4, p.567-99 (1983). In French.
Deals with the shakedown analysis of rotational plates and shells subjected to variable axisymmetric loading. The considered material is elastic-perfectly plastic with sandwich Tresca yield condition. The method is based on the Melan theorem of shakedown and this leads to lower bounds of the loading domain. Finite element techniques and mathematical programming procedures are used to obtain the solutions. (16 refs.)

118395 Carrying capacity of fibre bundles with varying strength and stiffness. J.Hult (Div. of Solid Mech., Chalmers Univ. of Technol., Gothenburg, Sweden), L.Travnicek.
J. Mec. Theor. & Appl. (France), vol.2, no.4, p.643-57 (1983).
The load-elongation characteristics of fibre bundles under tension is analyzed assuming certain variations of constitutive parameters among the fibres. Similarities are shown to exist between few-fibre bundles and a fibre continuum. Conditions for gradually occurring or instantaneous rupture are derived assuming various forms of the stress-strain curves. (14 refs.)

118396 Axisymmetric problem for elastic medium with a spherical inclusion weakened by a crack at the interphase boundary. M.A.Martinenko.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.38-42 (1983). In Ukrainian.
A problem on the stressed state of an elastic medium with a spherical inclusion when there is a crack at the interface is solved by exact methods of the linear theory of elasticity. At first the problem is reduced to an interrelated system of paired equations with respect to the Legendre functions, and then to a system of singular integral equations relative to two unknown functions. The behaviour of the equation solutions is studied near the interface circle of a spherical section. (6 refs.)

118397 Spatial problem for a deformable cone with a symmetrically disturbed surface. Yu.M.Nemish.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.42-5 (1983). In Ukrainian.
Three-dimensional boundary-value problems of deformable solid mechanics are discussed. The solid is bounded by a nearly conical surface. The solution procedure for such a problem is based on general ideas of the theory of disturbances. (8 refs.)

118398 Optimal strength design of beam-columns. S.Kanagasundaram, B.L.Larihaloo (Dept. of Civil Engng. & Surveying., Univ. of Newcastle, Newcastle, NSW, Australia).
Int. J. Solids & Struct. (GB), vol.19, no.11, p.937-53 (1983).
Considers the optimal design of elastic beam-columns which are acted upon simultaneously by an axial compressive and transverse forces. The design has to be such that it uses the least amount of material to achieve a prescribed strength under given loading conditions. Strength constraints are imposed to limit the intensity of maximum normal (flexural and axial) and shear stress within the member. The optimal designs are also checked against serviceability and buckling requirements. Concepts from Differential Game Theory are employed for the solution of the optimization problem. Solutions are presented for beam-columns of different cross-sectional shapes and boundary conditions subjected to various combinations of axial and transverse forces. (12 refs.)

118399 Fluid-structure interaction via boundary operator method. M.M.Cepkauskas, J.A.Stevens (Combustion Engng. Inc., Windsor, CT, USA).
J. Sound & Vib. (GB), vol.90, no.2, p.229-36 (22 Sept. 1983).
This paper is an examination of a simple fluid-structure interaction problem in which a technique for solving time dependent boundary condition problems, the boundary operator method (BOM), is used to gain further insight into fluid-structure response characteristics. The fluid-structure system consists of a compressible liquid having an acoustic pump at one boundary and a spring mass at the other boundary. The response of the spring mass as a result of the acoustic pulsations of the pump is the quantity of interest. This simple model closely represents a PWR core support barrel when excited by pressure waves due to circulating pump pulsations. The general solution of the pressure via the BOM is obtained as a function of the unknown spring mass response. This pressure is evaluated spatially at the spring mass end and the resulting equation of motion for the spring mass is found to be an integral-differential equation. Formulating the solution of the integral differential equation for a harmonic pump pulsation one obtains a normalized displacement of the spring mass as a function of three parameters. These parameters consist of a fluid to structure mass ratio, forcing frequency to uncoupled liquid natural frequency, and a ratio of forcing frequency to uncoupled structural frequency. A study is performed to determine the influence of the three parameters on the structural response. (8 refs.)

118400 Perturbation method in problems of optimizing plates of variable thickness. A.S.Bratus.
Mech. Solids (USA), vol.17, no.6, p.123-30 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.135-42 (1982). [received: Oct. 1983]
Considers problems of optimal design of beams and plates of variable thickness. Under the assumption that the control function (thickness) assumes values that differ from a fixed value in relatively narrow limits, the author constructs a solution that differs from the optimal solution with respect to the functional by a quantity on the order of the square of the perturbation. Error estimates are also proved and some examples offered. (8 refs.)

118401 Optimal shape of a reinforced column built up at a random rate. V.B.Kolmanovskii, V.V.Metlov.
Mech. Solids (USA), vol.18, no.1, p.83-93 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.18, no.1, p.91-101 (1983).
Considers the problem of optimizing the shape of a reinforced column that is erected at a random rate. The material of the column possesses properties of creep and nonuniform aging. The authors establish formulas in the general case that yield a solution of the problem in parametric form. For a number of characteristic situations, the authors obtain the optimal shape of the column numerically. It is established that the optimal shape depends strongly on the rate of erection. The authors analyze the relationship between the optimal shapes for deterministic and random rates of erection. (10 refs.)

118402 Optimal design of rigid-plastic beams of stepwise-constant height under impulsive loading. Yu.R.Lepik.
Mech. Solids (USA), vol.18, no.1, p.128-34 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.18, no.1, p.136-42 (1983).
The author investigates a beam with freely supported ends, derives the equations of motion and develops a procedure for solving them. The procedure allows one to take account of the motion of plastic hinges. The results are compared with those obtained by Martin and Symonds (1966) using the method of modal motions. (14 refs.)

118403 Stress-strain state of orthotropic multilayer shells. A.N.Ul'yashina.
Mech. Solids (USA), vol.18, no.1, p.146-55 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.18, no.1, p.155-66 (1983).
Proposes a version of the theory of inhomogeneous orthotropic shells that takes account of all transverse components of the deformation. A distinctive feature of this version is the kinematic model which defines the distribution of the displacements over the thickness in terms of the unknown displacements and stresses on some initial surface, and that yields the resolved system in mixed form. The solution of this system identically satisfies all the initial three-dimensional equations except for the elasticity relations for the transverse stresses (ignored in the classical theory), which are satisfied only on the initial surface. (9 refs.)

118404 On the equations of elastodynamics of bar mechanisms. M.Buculei.
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.3, p.255-60 (May-June 1983). In French. [received: Sept. 1983]
Starting from the kinematics and kinetics of linear-elastic solids in roto-translative movement, the equations of motion are given in integral form. By means of the Cauchy-Helmholtz equations and taking account of the compactness of the elastic solid a relation for the field of velocities is deduced. Finally an algorithm of elastodynamic analysis of bar mechanisms is given. (9 refs.) *J.S.*

118405 A free boundary value problem in plate theory. P.Villaggio (Istituto di Sci. delle Costruzioni, Univ. di Pisa, Pisa, Italy).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.2, p.297-302 (June 1983).
Studies the equilibrium configuration of a thin rectangular plate, supported on an elastic foundation that reacts in compression only. It is assumed that the foundation is described by the Winkler model in the contact region. The plate is supposed to be weightless and subjected to a concentrated load in its midpoint. The shape of the free boundary, where the plate loses contact with the foundation, is determined. (6 refs.)

Analysis of shear lag in cylindrical tubes of arbitrary cross section ....See Entry 118447

Modal balancing of flexible rotors without test runs: an experimental investigation ....See Entry 118538

46.30 MECHANICS OF SOLIDS AND RHEOLOGY

(see also 62.20 Mechanical properties of solids, as related to microscopic structure)

118406 On the relationship between a dimensional and a thermodynamic peculiarity of the power law constitutive equation. G.Astarita.
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.2, p.223-4 (Sept. 1983).
The author published a paper in 1977 where it was shown that the power-law constitutive equation is a somewhat special case in a thermodynamic sense. The point is as follows. For all purely viscous fluids where the stress is given by an equation of the form $\tau=f(\alpha)D$, where $\alpha=\mathrm{Tr}(D^2)$, a variational principle of the Helmholtz-Korteweg type can be constructed. However, only for power-law fluids (including Newtonian ones) the quantity H to be minimized is proportional to the total rate of energy dissipation Δ (or of entropy production Δ/T). In fact the variational principle has no thermodynamic content whatsoever, and the proportionality of H and Δ for power-law fluids is fortuitous. The power-law constitutive equation is dimensionally special. In fact, only power-law fluids are endowed with only one dimensional rheological parameter, viz. the consistency K. All other fluids have two dimensional parameters, say a characteristic stress τ_0 and a characteristic shear rate γ_0. In the 1977 paper, it was suggested that the two peculiarities are perhaps related to each other. The purpose of the communication is to show that such is indeed the case. (1 ref.)

118407 Upper-bound analysis of hot extrusion of axisymmetric rods and tubes. I. Mathematical modelling of hot extrusion. C.Teodosiu, I.Rosu, T.Dumitrescu (Inst. for the Phys. & Technol. of Materials, Bucharest, Rumania).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.3, p.317-41 (May-June 1983). [received: Sept. 1983]
Accurate evaluations of the extrusion pressure and of its dependence on technological parameters such as extrusion ratio, semicone die angle, ram speed, and coefficients of friction, are of great practical interest, since they allow the elaboration and/or the optimization of new technologies without resorting to expensive experiments on industrial scale. Moreover, by adopting a mathematical model close to the real process, it becomes possible to evaluate the variation of the stresses, strains, strain rates, and temperatures throughout the process. Finally, a reliable model permits the laboratory simulation, e.g. by hot torsion tests, of the real deformation process, thus providing a rather simple means for the experimental comparison of various technological schemes. (10 refs.)

118408 Stresses in a semi-infinite body having a semi-spherical pit under uniaxial tension. T.Fujita (Dept. of Appl. Phys., Nat. Defense Acad., Yokosuka, Japan), E.Tsuchida, I.Nakahara.
Sci. & Eng. Rep. Natl. Def. Acad. (Jpn.) (Japan), vol.20, no.3, p.265-80 (Nov. 1982). In Japanese. [received: Aug. 1983]
The authors present an asymmetric solution for the stress distributions around a hemispherical pit at a plane surface of a semi-inifinite body under uniaxial tension. In the analysis, eight stress functions are chosen so as to fulfil the boundary conditions automatically, both at the plane surface and at infinity. On the other hand, the remaining boundary conditions at the surface of the pit are satisfied with the aid of the 'half-range expansion' technique. Numerical results are given for the variations around the pit and along the z-axis and compared with the corresponding results under biaxial tension. (13 refs.)

118409 Use of coefficients of influence to solve some inverse problems in plane elasticity. A.J.Durelli (Dept. of Mech. Engng., Univ. of Maryland, College Park, MD, USA), D.Wu.
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.2, p.288-96 (June 1983).
The principle of superposition of the order of isochromatic fringes and the concept of the coefficient of influence of the order of those fringes are introduced. The method is proposed to solve some inverse problems in elasticity and is applied to the determination of the forces that act at the points of contact between disks loaded in their plane. For this purpose Michell equations are used to determine the stresses at selected points of a disk and the coefficients of influence are computed numerically. The method can be generalized to other plane bodies loaded in the plane and if no theoretical solution is available the problem could be solved completely experimentally. The application presented is related to a study of discrete, or granular, media. (7 refs.)

The mechanical properties of cellular solids ....See Entry 120377
Impact experiments on ice ....See Entry 121560

46.30C Static elasticity

118410 Bifurcation of an elastic slab having inclined anisotropy-axes under axial loads. M.Kurashige (Dept. of Mech. Engng., Tohoku Univ., Sendai, Japan).
Bull. JSME (Japan), vol.26, no.216, p.954-7 (June 1983).
Bifurcations from a homogeneous, finite, stretch-shear-combined deformation are studied for a transversely isotropic, compressible, elastic slab having inclined anisotropy-axes which is subjected to uniform axial loads, tensile and compressive. The bifurcations are analyzed on the basis of the incremental deformation theory. For various wavelength-to-thickness ratios, the critical loads are shown in the form of curves as a function of anisotropy-axis inclination. (13 refs.)

118411 Nonlinear stress analysis of offshore pipelines during pickup operations. K.A.Ansari (Mech. Engng., Univ. of Petroleum & Minerals, Dhahran, Saudi Arabia).
Comput. & Struct. (GB), vol.18, no.2, p.357-63 (1984).
Presents a method of analyzing the stresses in a submarine pipeline as it is picked up off the sea floor by barge davits. A nonlinear large-deflection analysis is used and the pipeline is modeled as a series of finite beam segments from the ocean bottom on up. The governing equations are derived and the pipeline configuration satisfying known boundary conditions is determined by an initial-value approach using an iterative-type technique. Boundary conditions at the mudline are identified by modeling the pipeline resting on the ocean bed as a semiinfinite tensioned beam on an elastic foundation. The effects of a nonlinear stress-strain curve for the pipe material are included and both Ramberg-Osgood and Hutchinson formulations are considered. With the technique suggested, any given pickup procedure can be analyzed or a reliable procedure can be developed based on a given, allowable pipe stress level and any desired improvement in the final configuration and/or stress levels may be achieved by a variation of the parameters involved. A practical example is examined to demonstrate the applicability of the analysis presented, which should provide a useful tool in either judging or developing a pickup procedure. (10 refs.)

118412 Numerical optimum design of elastic annular plates with respect to buckling. K.Rzegogcinska-Pelech, Z.Waszczyszyn (Tech. Univ. of Kracow, Krakow, Poland).
Comput. & Struct. (GB), vol.18, no.2, p.369-78 (1984).
Annular plates of fixed volume, under uniform radial edge compression are considered. The plate is divided into N segments of linearly variable or constant thickness. Geometrical constraints for the segment thickness and for the effective stress are assumed. Two types of objective functions are explored: (I) maximum value of critical load at the fixed number of circumferential buckling half-waves j, (II) unimodal optimum design for such a number j that buckling load equals max $(\inf_j|P^j|)$. The shooting method is applied to compute the distribution of axial forces in the prebuckling state and the basic buckling load for the plate of variable thickness. The optimal distribution of segment thicknesses χ_k for $k=1, ..., N$ are computed by means of Rosenbrock's method with internal penalty function. Results of numerical analysis are reported for both the optimum design problems I and II. (7 refs.)

118413 A study on GRP skin/foam core sandwich structures. S.K.Malhotra, B.J.C.Babu (FRP Res. Centre, Indian Inst. of Technol., Madras, India).
Composites (GB), vol.14, no.4, p.383-6 (Oct. 1983).
Presents a simple graphical procedure which allows a structural sandwich beam or panel to be designed from GRP skin and foam core materials, so that the weight of the sandwich is a minimum. The method is based upon the well-known equations for bending rigidity, bending moment and weight of a sandwich beam. (2 refs.)

118414 Thermoelastic equations for thick walled shells. M.M.Belyaev, V.I.Zavelion, O.A.Ryadno.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.21-3 (1983). In Ukrainian.
A method is suggested for studying the heat-stressed state of thick-walled shells with a median surface of an unknown shape. The results obtained from solution of test problems are in agreement with exact solutions within the errors admissible in engineering practice. (6 refs.)

118415 Note on shear interaction between two fibers. S.B.Batdorf (Dept. of Materials Sci. & Engng., Univ. of California, Los Angeles, CA, USA).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1207-10 (1983).
The shear lag approximation for stress distributions in damaged composites employed by Hedgepeth and Van Dyke (see J. Composite Mater, vol.1, p.294, 1967) and later by others, employs an effective shear stiffness, Gh to describe the role of the matrix in transferring direct stress from a fiber to a neighboring fiber. In their treatment it was assumed that the force per unit length transferred between fibers 1 and 2 is given by $F'=A_f(d\sigma/d_3)=Gh(w_2-w\omega_1)/d$, where A_f is fiber area, σ is fiber stress, G is the matrix shear modulus, d is distance between fiber centers, and w_2-w_1 is the relative axial displacement. Shear lag was originally devised as a technique for obtaining stress distributions in aircraft sheet-stiffener combinations. In that context d is the distance between rivet lines and h is sheet thickness. In extending the analysis to a 3D composite d remains well-defined, but loses physical significance, since $(w_2-w_1)/d$ no longer serves as a direct measure of shear strain. But h is undefined, and loses physical significance as well. The present authors give an exact analytical treatment of h for limiting case of a single pair of fibers. (9 refs.)

118416 Torsion of elastic space with cylindrical cavity and ring cut. M.A.Kerimov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.1, p.137-40 (1983). In Russian.
The problem of the torsion of an elastic space with a cylindrical cavity and a ring cut with perforations is examined. By a method of dual integral equations this problem is reduced to Fredholm integral equations of the second kind. An asymptotic solution is found in case of a deep cut. (5 refs.)

118417 Shear-band bifurcation of an isotropic compressible hyperelastic solid. M.Kurashige (Dept. of Mech. Engng. II, Faculty of Engng., Tohoku Univ., Sendai, Japan).
J. Elasticity (Netherlands), vol.13, no.3, p.243-56 (1983).
Concerns shear-band bifurcations from the homogeneous finite plane deformation of an isotropic compressible hyperelastic solid. The governing equations for the incremental plane deformation superposed on the initial finite deformation are derived and then the equilibrium equations in terms of incremental displacements are classified into the elliptic type, parabolic type, etc. From this classification follows a restriction which should be placed on the strain-energy function in order that the equilibrium equations may be either elliptic or parabolic for all principal stretches. For the hyperelastic solid complying with this restriction, the condition for the shear-band bifurcation is obtained. Finally, the incremental displacement field of an infinite series of shear bands in a slab sandwiched between slippery rigid layers is established. (11 refs.)

118418 A note on bi-orthogonality relations for elastic cylinders of general cross section. R.D.Gregory (Dept. of Materials, Univ. of Manchester, Manchester, England).
J. Elasticity (Netherlands), vol.13, no.3, p.351-5 (1983).
The bi-orthogonality relation satisfied by the elastodynamic (or elastostatic) eigenfunctions of a cylindrical rod of general cross section is obtained by a simple argument. The relation is shown to depend only upon (i) the elastic reciprocal theorem, and (ii) the elastic symmetry of the cylinder in planes perpendicular to its generators. (11 refs.)

118419 Calculation of the elastic characteristics of a unidirectional fiber composite by the cross-section method. S.S.Abramchuk, I.P.Dimitrienko, V.N.Kiselev.
Mech. Compos. Mater. (USA), vol.18, no.6, p.641-7 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.970-6 (Nov.-Dec. 1982). [received: Sept. 1983]
Relationships have been derived for the calculation of the elastic characteristics of a unidirectional composite with anisotropic components by the cross-section method. It has been shown that the successive application of the cross-section method leads to breakdown of the symmetry of the elastic properties of an individual element. Averaging of the elastic characteristics obtained for individual elements over the nodes in the 2-3 plane permits the bringing of the computational results closer to the properties of actual composites. The computational results were in satisfactory agreement with the experimental data. (8 refs.)

118420 Quasi-static problem of the mechanics of a deformable solid in the stresses. B.E.Pobedrya, T.Kholmatov.
Mech. Solids (USA), vol.17, no.6, p.49-52 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.55-8 (1982). [received: Oct. 1983]
A new formulation (including a variational formulation) is offered to the quasi-static problem of nonlinear mechanics of a deformable solid in the stresses, which involves the solution of six equations for the six independent components of the symmetrical stress tensor while satisfying six boundary conditions. For an isotropic elastic medium it is established that the 'energy functional' is positive-definite. It is demonstrated that the problem in question is elliptic. (6 refs.)

118421 Stressed state of a strip with one or two elastically reinforced circular holes. N.I.Mironenko.
Mech. Solids (USA), vol.17, no.6, p.66-72 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.73-80 (1982). [received: Oct. 1983]
Investigates the stressed state of a strip with one or two circular holes reinforced by elastic rings. A numerical analysis is offered for two cases, in which the reinforcing rings are 'stiffer' or 'softer' than the strip. (6 refs.)

118422 On the determination of the three-dimensional stressed state of sandwich plates with transverse-isotropic layers. V.A.Galich, V.A.Shaldyrvan.
Mech. Solids (USA), vol.17, no.6, p.119-22 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.131-4 (1982). [received: Oct. 1983]
On the basis of Vorovich's semi-inverse method (1970), the authors construct and investigate some properties of homogeneous solutions in the problem of extension-compression of a sandwich plate of symmetrical structure with transtropic layers. Using projection methods, they consider the problem of passage in the limit from the three-dimensional to the two-dimensional problem, and formulate boundary-value problems for multiply connected bodies of finite size. (7 refs.)

118423 Bending of a reticular plate with allowance for transverse shear deformation. G.I.Pshenishnov, E.D.Tagi-Zade.
Mech. Solids (USA), vol.17, no.6, p.131-4 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.143-7 (1982). [received: Oct. 1983]
Considers the transverse bending of a rectangular plate consisting of a large number of rigidly coupled rods whose axes lie on a plane called the center plane. One of the principal central axes of the cross section of each rod of the plate belongs to its center plane. It is also assumed that all the rods of the plate can be divided into a series of families, each of which is characterized by the fact that the axes of its rods form a family of close-lying smooth nonintersecting curves on the center plane. The number n of such families is arbitrary but is greater than 1. A solution of the problem is obtained on the basis of a continual theoretical model. It is shown that, if the torsional stiffness of the rods can be disregarded, calculations for a plate with a rhombic lattice reduce to calculations for a plate with a square lattice. Some numerical results are given. (1 ref.)

118424 Singular integral equations in micropolar thermoelasticity. I.Craciun, A.Craciun (Dept. of Maths., Polytech. Inst. of Iasi, Iasi, Rumania).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.4, p.347-56 (July-Aug. 1983).
The linear theory of micropolar thermoelasticity in the case of stationary vibrations for an isotropic, homogeneous and centrosymmetric solid is considered. There are formulated two boundary value problems of this theory. After the introduction of two surface micropolar thermoelastic potentials, the boundary value problems are considered reduced to singular integral equations. (15 refs.)

118425 Non-simple quasi-static thermoelastic deflection of a thin clamped circular plate. A.K.Dhar (Dept. of Maths., Jadavpur Univ., Calcutta, India).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.4, p.431-7 (July-Aug. 1983).
A non-simple quasi-static thermoelastic deflection of a thin clamped plate due to a Ramp-type heating on the upper surface of a concentric circular region has been found out. The Laplace transform has been used to solve the problem. Finally, thermal normal deflection has been found out in terms of infinite series. (10 refs.)

118426 Dynamic stress concentration around a circular hole in an infinite elastic strip. S.Itou (Dept. of Mech. Engng. & Energy, Hachinohe Inst. of Technol., Hachinohe, Japan).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.57-62 (March 1983). [received: Oct. 1983]
Transient response of an infinite elastic strip with a circular hole is investigated. A normal stress is suddenly applied and maintained at the hole. The boundary condition equations are satisfied in the Laplace transformed domain. A numerical Laplace inversion technique is then used to recover the time dependence of the solution. (8 refs.)

118427 The effect of a normal shock on the aeroelastic stability of a panel. M.H.Williams (School of Aeronautics & Astronautics, Purdue Univ., West Lafayette, IN, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.2, p.275-82 (June 1983).
The effect of a standing shock wave on the static and dynamic aeroelastic stability of a flexible panel is investigated using a linear structural and aerodynamic theoretical model. It is found that the shock is generally stabilizing. The lowest critical dynamic pressures are associated with shock positions downstream from the panel, where the panel is uninfluenced by the shock. (4 refs.)

A note on the solutions of Boussinesq, Love, and Marguerre in axisymmetric elasticity .... See Entry 116994

Stress-strain state of orthotropic multilayer shells .... See Entry 118403

Generalised problem of thermoviscoelasticity of a layer under the action of a time-random stress-thermal field .... See Entry 118434

Torsional stability of elastic rods .... See Entry 118454

Influence of finite initial deformations on the velocity of Rayleigh waves in an incompressible half-space .... See Entry 118466

Eulerian formulation of transport equations for three-dimensional shock waves in simple elastic solids .... See Entry 118474

On the dissipation inequality in equilibrium shocks .... See Entry 118475

On the transverse vibration of a rubber string .... See Entry 118476

Properties of a wave field in a semi-infinite elastic cylinder (boundary resonance) .... See Entry 118479

Universal characteristic equations in problems of vibration and stability of elastic systems .... See Entry 118480

On the radiation and diffraction of the two dimensional elastic waves in an infinite domain of homogeneous medium .... See Entry 118487

Numerical and experimental study of stress concentration in elastic solids .... See Entry 118491

Large deformations near a tip of an interface-crack between two Neo-Hookean sheets .... See Entry 118515

Stationary subsonic motion of a cut in an elastic strip .... See Entry 118517

Bounds and approximate formulas in the problem of a plane normal-separation crack in elasticity .... See Entry 118520

Contact problem for elastic bodies with circular boundaries at the onset of wear .... See Entry 118530

Problem of intersection of two half-planes with reinforced edges .... See Entry 118532

46.30J Viscoelasticity, plasticity, viscoplasticity, creep, and stress relaxation

(inc. rheology of solids)

118428 Visco-plastic large deformation analysis by finite element method and its applications. Inextensional deformation of thin-walled square tube. K.Murase, H.Katori, T.Nishimura (Meijo Univ., Nagoya, Japan).
Bull. JSME (Japan), vol.26, no.216, p.923-9 (June 1983).
Treats a problem of inextensional deformation collapse of a thin-walled square tube under axial compressive impulsive load. The analytical method is based on visco-plastic large deformation analysis involving material and geometrical nonlinearity. The results of calculation are compared with the experimental ones, and the dynamic characteristics of the thin-walled square tube are discussed. (11 refs.)

118429 Estimation of stress and strain at the notch root in the elastic-plastic range using the J-integral. N.Miki (Faculty of Engng., Ehime Univ., Ehime, Japan), K.Ogura, K.Ohji.
Bull. JSME (Japan), vol.26, no.216, p.930-7 (June 1983).
An elastic-plastic analysis of notched plates was made. The J-integral of the notched plates was computed, and the relations between the value of J-integral and the stress and strain at the notch root were discussed. It was found that a master-curve representation of the stress σ or the strain ϵ at the notch root was possible on a σ/σ_Y(or ϵ/ϵ_Y)-J/J_{yield} diagram (σ_Y:yield stress, ϵ_Y:yield strain, J_{yield}:the J-integral value at which notch root yielding starts). The J-integral was found to be aproximately given as $J=J_{\text{linear}}$(=elastic J-integral) when $P/P_{GY}\leq 1$, regardless of the stress condition, the elastic stress concentration factor K_t and the strain hardening characteristics of the material (P:the applied load, P_{GY}:the gross yield load of the respective notched plate). By combining these two findings, a simple method was proposed to estimate the stress and strain at the notch root in the elastic-plastic range up to gross yielding. (8 refs.)

118430 A finite element method for elastic-plastic beams and columns at large deflections. C.Chebl, K.W.Neale (Dept. of Civil Engng., Univ. de Sherbrooke, Sherbrooke, Quebec, Canada).
Comput. & Struct. (GB), vol.18, no.2, p.255-61 (1984).
A finite element scheme for the large-displacement analysis of elastic-plastic beams and columns is presented. The proposed method, which assures continuous deflections and continuous slopes at the element junctions, is shown to furnish fairly accurate results with a minimum number of elements. Comparisons are made with existing results for laterally loaded beams on elastic foundations and for elastic columns on bi-linear elastoplastic foundations. The effect of imperfections on the buckling of elastic-plastic columns is also investigated. (8 refs.)

118431 A three-dimensional nonlinear analysis of cross-ply rectangular composite plates. T.Kuppusamy, J.N.Reddy (Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Comput. & Struct. (GB), vol.18, no.2, p.263-72 (1984).
The results of a three-dimensional geometrically nonlinear, finite-element analysis of the bending of cross-ply laminated anisotropic composite plates are presented. Individual laminae are assumed to be homogeneous, orthotropic and linearly elastic. A fully three-dimensional isoparametric finite element with eight nodes (i.e. linear element) and 24 degress of freedom (three displacement components per node) is used to model the laminated plate. The finite element results of the linear analysis are found to agree very well with the exact solutions of cross-ply laminated rectangular plates under sinusoidal loading. The finite element results of the three-dimensional, geometrically nonlinear analysis are compared with those obtained by using a shear deformable, geometrical nonlinear, plate theory. It is found that the deflections predicted by the shear deformable plate theory are in fair agreement with those predicted by three-dimensional elasticity theory; however stresses were found to be not in good agreement. (21 refs.)

118432 Effect of shear deformation on the yielding of circular plates. G.J.Turvey (Dept. of Engng., Univ. of Lancaster, Lancaster, England).
Comput. & Struct. (GB), vol.18, no.2, p.307-10 (1984).
Shear Deformation Plate Theory (SDPT) is used to analyse the first yield response of axisymmetric circular plates. Expressions for the first yield pressure and the associated plate centre deflection of uniformly loaded, simply supported and clamped plates are presented. corresponding Classical Thin Plate Theory (CPT) expressions are also deduced. It is demonstrated that the SDPT and CPT expressions are related via correction factors which are functions of the plate thickness-ratio β, and Poisson's ratio. Graphs of the correction factors plotted against β are presented. They illustrate that inherent shear flexibility causes a slight reduction in the first yield pressure compared with the CPT value when the plate edges are simply supported and a slight increase when they are clamped. Plate centre deflections are, however, increased significantly for both support conditions. (6 refs.)

118433 A curvilinear triangular finite element for plate bending by a hybrid method of assumed displacements supplemented with assumed stresses. L.S.D.Morley (Structures Dept., Royal Aircraft Establ., Farnborough, England).
Comput. & Struct. (GB), vol.18, no.2, p.311-18 (1984).
A curvilinear triangular finite element is described for plate bending problems. The geometry is in quadratic parametric representation. The method employs assumed displacements supplemented with assumed stresses and is embedded in Kirchhoff theory. The curvilinear finite element is designed to pass exactly the patch test for constant curvature changes when the flexural rigidity is constant. Rigid body movements are always exactly recovered. Numerical evidence is provided on patch tests for linearly varying curvature changes. (4 refs.)

118434 Generalised problem of thermoviscoelasticity of a layer under the action of a time-random stress-thermal field. L.K.Shelyag.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.13-17 (1983). In Ukrainian.
Basic probability characteristics of a thermoviscoelastic field resulting in a viscoelastic homogeneous layer from the effect of a time-random stress-thermal field are plotted in terms of the correlation theory. (5 refs.)

118435 Creep of thin shells interacting with rigid bodies. G.I.L'vov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.24-6 (1983). In Ukrainian.
A variational statement is suggested for the contact problem of unsteady-state creep of thin shells interacting with rigid bodies. The existence and uniqueness of a local solution are proved on the basis of the theory of variational inequalities. (6 refs.)

118436 Rate sensitivity of plastic flow and implications for yield-surface vertices. J.Pan (Stress Analysis & Fracture Section, Batelle Columbus Labs., Columbus, OH, USA), J.R.Rice.
Int. J. Solids & Struct. (GB), vol.19, no.11, p.973-87 (1983).
When crystalline slip is considered as the micromechanism of plastic deformation in polycrystals and the slip process is assumed to be rate-independent, the formation of a vertex is predicted on the current yield surface in stress-space. Experiments which were conducted to confirm the existence of such a vertex are known to have produced ambiguous results: e.g. a superimposed shear during compressive loading was found to produce an initially elastic response. If one considers that the crystalline slip process is slightly rate-dependent, however, then one can furnish a reasonable explanation for this elastic behaviour in shear. The authors illustrate the point by considering first a single crystal model undergoing double slip, and then a polycrystal model based on the slip concepts of Batdorf and Budiansky.The results presented, based on the assumption that the slip process is not rate-independent, but rather at least slightly rate-dependent, give agreement, and reasonable quantitative agreement, to experimenal results for superposed shear during compressive loading. They also suggest that the actual rate sensitivity of plastic flow may be central to understanding the ambiguous conclusions from experimental attempts to fine yield surface vertices. (21 refs.)

118437 The plastic η factor for a deeply cracked beam with tension of the small remaining ligament. E.Smith (Metall. Dept., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
Int. J. Fract. (Netherlands), vol.23, no.1, p.R23-7 (Sept. 1983).
The η factor relates the J integral to the work per unit uncracked ligament area when a cracked body is loaded. Thus if the displacement is separated into elastic and plastic components δ_{EL} and δ_{PL}, and the J integral into elastic and plastic components J_{EL} and J_{PL}, while the elastic work W_{EL} is defined as the work recovered during linear elastic unloading (with the crack length fixed) from any point on an elastic-plastic load-displacement record, the elastic η factor η_{EL} is defined by the relation $J_{EL}=\eta_{EL}W_{EL}/2BL$, where 2L and B are respectively the length and thickness of the uncracked ligament. The plastic η factor η_{pL} is defined in a manner consistent with its elastic counterpart: $J_{PL}=\eta_{PL}W_{EL}/2BL$. (5 refs.)

118438 Hydraulic impact in circular visco-elastic shells. T.A.Nasibov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.1, p.129-36 (1983). In Russian.
The phenomenon of the hydraulic impacts in circular visco-elastic shells with an ideal liquid is investigate. With the help of Laplace transformations a solution of the problem is found. (7 refs.)

118439 The investigation of the behaviour of an elastic-plastic thick-walled tube under irradiation. A.S.Gulgazli, D.I.Isaev.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.1, p.141-4 (1983). In Russian.
The problem of the strength of an elastic-plastic thick-walled tube undergoing neutron radiation is considered. It is calculated that the limit of fluidity is a function of radiation dose. The plastic characteristics of the material constant. The expression for the stress both in elastic and plastic zones is obtained. (4 refs.)

118440 Use of nonlinear models of viscoelasticity in the investigation of the effect of hydrostatic pressure on the shear creep of polymeric materials. A.Ya.Gol'dman, G.Kh.Murzakhanov, N.P.Demenchuk ('Plastopolimer' Okhtinsk Sci.-Industrial Assoc., Leningrad, USSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.637-40 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.965-9 (Nov.-Dec. 1982). [received: Sept. 1983]
Two nonlinear models are presented which provide a sufficiently accurate description of the shear creep under an imposed hydrostatic pressure which increases monotonically at a constant rate. (7 refs.)

118441 Compression failure of a unidirectional fibrous composite with an elastoplastic matrix. A.N.Guz', M.A.Cherevko (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.656-63 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.987-94 (Nov.-Dec. 1982). [received: Sept. 1983]
It is concluded that drawing upon the three-dimensional linearized theory of stability to solve problems of the compression failure of unidirectional fibrous composite materials with an elastoplastic matrix is effective and makes it possible to predict sufficiently accurately the breaking loads. (16 refs.)

118442 Statistical theory of fibrous media. I. Longitudinal shear. G.A.Vanin (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.704-10 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.1043-50 (Nov.-Dec. 1982). [received: Sept. 1983]
A statistical theory of fibrous material is presented which relates their physical, mechanical, and strength characteristics to the properties of the components with consideration of the manufacturing technology parameters—scatter in the properties and geometry of the fibers and matrix, distributed imperfections in the phases of the medium and at the phase boundaries, stacking faults of the material, and others. (10 refs.)

118443 Conservation laws for an elastic-viscoplastic medium with finite deformations. V.I.Kondaurov.
Mech. Solids (USA), vol.17, no.6, p.91-101 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.100-11 (1982). [received: Oct. 1983]
Investigates the general equations of the theory of flow of a finite-deformed elastic-plastic medium with dynamic hardening. A new kinematic equation, is proposed in the form of a conservation law, that links the velocity of the total-displacement gradient with the gradients of the particle velocities. This form of the equation makes it possible to write the complete system of equations in the form of a system of conservation laws in arbitrary curvilinear moving coordinates. It is shown that, in contrast to the case considered, the equations of flow theory for a plastic solid that is insensitive to the deformation rate are incapable in principle of being reduced to divergent form. The characteristic properties of the system are investigated in the adiabatic approximation. A symmetrization of the equations is offered and sufficient hyperbolicity conditions formulated. Without introducing any additional assumptions, a closed system of relations on strong discontinuities is written. The authors consider the existence and uniqueness conditions for the solution of the problem of calculating the quantities behind a shock-wave front when the state ahead of the front is known and the wave velocity is specified. (8 refs.)

118444 Mixed variational principle of creep theory in problems of long-term strength. M.V.Sergeev.
Mech. Solids (USA), vol.17, no.6, p.102-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.112-16 (1982). [received: Oct. 1983]
A modification of the mixed variation principle of creep theory is proposed in relation to problems of long-term strength, such that it is possible to take account of accumulation of damage to the material within the framework of one functional. (12 refs.)

118445 Deformation of materials with defects. A.V.Berezin.
Mech. Solids (USA), vol.17, no.6, p.113-18 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.124-30 (1982). [received: Oct. 1983]
Formation of defects in the body, as well as changes in the size of the defects under load, causes the body to have differing deformation characteristics in different stressed states. This fact has previously been confirmed experimentally for the case of deformation of porous materials. The present author establishes a relationship between the deformation characteristics and the growth conditions for microdefects in various stressed states. A plastic body is considered whose deformation involves formation and change in size of microcracks. It is assumed that when the stress-strain state achieves the conditions for initiation of microcracks in the slip system there appear k_0 defects of size R_0 per unit area; under subsequent deformation the intact part of the slip plane is shear-deformed, the magnitude of the shear depending only on the defective tangential stress which is larger than its preceding values; the change in the size of the microcracks is determined by their growth condition. (17 refs.)

118446 Solutions of singular problems of torsion of an elastic/ideally plastic rod. A.M.Protsenko.
Mech. Solids (USA), vol.18, no.1, p.94-8 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.18, no.1, p.102-6 (1983).
Looks at the problem of torsion of a rod whose cross section contains the vertex of a re-entrant angle. The author proves the existence of singular fields of the self-stresses and, as a result, that the stress field is regular for the plasticity problem. Discusses methods of solving such problems and some results of their implementation, using the example of the finite-element method. (4 refs.)

118447 Analysis of shear lag in cylindrical tubes of arbitrary cross section. W.H.Wittrick (Dept. of Civil Engng., Univ. of Birmingham, Birmingham, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1797, p.259-77 (8 Oct. 1983).
A very general analysis is given of the phenomenon of shear lag in thin-walled cylindrical tubes, with single-cell cross sections of arbitrary shape, containing any number of concentrated longitudinal booms that carry direct stress only, and subjected to any longitudinal distribution of bending moment and torque. Two equations relating the distributions of direct and shearing stresses on the cross section are derived for the most general case where the tube is non-uniform because of an arbitrary longitudinal variation of wall thicknesses and boom areas. These equations, which are remarkably simple in view of their generality, incorporate all the requirements of equilibrium and compatibility and provide corrections to the stresses, curvature and twist calculated from the engineers' theory of bending and torsion. They also govern the distribution of stresses arising from the application of self-equilibrating systems of tractions to the end cross sections. Exact solutions are obtained for the case of a uniform, but otherwise arbitrary, cross section under any polynomial distribution of bending moment and torque, and it is shown how conditions at the end cross sections can be satisfied with the aid of solutions of a simple eigenvalue problem. (5 refs.)

118448 Stress couple concentrations for cylindrically bent plates with circular holes or rigid inclusions. E.Reissner (Dept. of Appl. Mech. & Engng. Sci., Univ. of California, San Diego, La Jolla, CA, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.85-7 (March 1983). [received: Oct. 1983]
The authors obtain explicit solutions for the two problems considered, in terms of Poisson's ratio ν and in terms of a parameter μ which is of the order of the ratio of hole radius a to plate thickness h, through application of a sixth-order theory of shear deformable plates, with this solution involving distinct edge zone and interior solution contributions when $1 \ll \mu$. It is shown that in this range some relevant asymptotic Bessel function formulas furnish explicit examples concerning the distinction between first-order shear corrections and second-order (Timoshenko-type) shear corrections which have been established in a recent general analysis. (4 refs.)

Rate forms of tensor field defined in nonlinear continuum mechanics .... See Entry 116995

Wave propagation near curvilinear boundaries of viscous piecewise homogeneous media .... See Entry 116998

Numerical plastic shakedown analysis of plates and shells of revolution by equilibrium finite elements .... See Entry 118394

Optimal shape of a reinforced column built up at a random rate .... See Entry 118401

Optimal design of rigid-plastic beams of stepwise-constant height under impulsive loading .... See Entry 118402

Bending of a reticular plate with allowance for transverse shear deformation .... See Entry 118423

Elasto-plastic buckling of stiffener plates in beam-to-column flange connections .... See Entry 118449

Stability and optimization of viscoelastic cylindrical shells made out of composites under combined loading .... See Entry 118453

Geometrical theory of stability of shells .... See Entry 118456

Plastic buckling of initially imperfect stiffened cylinders in axial compression .... See Entry 118459

Large-amplitude vibration of an initially stressed thick circular plate .... See Entry 118462

Structures for solving the problems in plate theory with mixed boundary conditions .... See Entry 118467

Bending vibration of a simply supported rectangular plate with a crack parallel to one edge .... See Entry 118468

Oscillations of a multilayer cylindrical panel with anisotropic layers under large deflections .... See Entry 118477

On interaction of thermo-acoustic waves with the progress of phase transition: a continuum approach. II. Growth and decay of thermo-acoustic waves .... See Entry 118484

Determination of the crack stability parameters of materials using acoustic signal characteristics .... See Entry 118492

Effects of crack growth on the load-displacement characteristics of precracked specimens under bending .... See Entry 118494

The geometry dependence of the J_β curve for circumferential growth of through-wall cracks in cylindrical pipes subject to bending loads .... See Entry 118495

Characteristics of brittle fracture under general combined modes including those under bi-axial tensile loads .... See Entry 118497

Upper and lower bounds for energy-release rates in an elastic body .... See Entry 118505

Distribution function of dislocations and condition of finite stress for the dislocation-free zone model of fracture .... See Entry 118511

Viscoelastic crack growth .... See Entry 118512

The geometry dependence of the J_R curve for the growth of a deep crack in a solid subjected to bending deformation .... See Entry 118514

Stress redistribution in a ruptured fiber of a viscoelastic composite .... See Entry 118516

Brittle fracture under creep .... See Entry 118518

Stress redistribution in a rupturing fiber as it peels away from a viscoelastic matrix of composition material .... See Entry 118519

On the problem of thermal failure under rapid heating .... See Entry 118521

One solution of the contact problem of nonlinear steady creep for a half-plane .... See Entry 118533

Predicting the creep of unidirectional reinforced plastic with thermorheologically simple structural components .... See Entry 118539

Analysis of mechanical relaxation processes in materials based on heat-resistant polymers .... See Entry 120363

Experimental investigation of the stability of fiberglass cylindrical shells subject to prolonged application of twisting moments .... See Entry 120380

Study of the relationship between fracture toughness (J_{IC}) and bulge ductility .... See Entry 120403

46.30L Static buckling and instability

118449 Elasto-plastic buckling of stiffener plates in beam-to-column flange connections. H.A.El-Ghazaly, R.N.Dubey, A.N.Sherbourne (Univ. of Waterloo, Waterloo, Canada).
Comput. & Struct. (GB), vol.18, no.2, p.201-13 (1984).
The problem of plastic buckling of steel plates is reviewed in relation to the load carrying capacity of stiffener plates in beam-to-column flange connections. Due to the nonuniformity of the stress distribution in these plates, the finite element method is used to compute the stresses in the elastic and plastic ranges. A bifurcation analysis is performed using both flow and deformation theory to evaluate the elasto-plastic buckling of the stiffener. A scaled inverse interactive version of the power method is employed to evaluate the bifurcation load. A parametric study is conducted on stiffeners and design curves are obtained showing the relationship between the critical stress and the slenderness ratio for different plate aspect ratios. (38 refs.)

118450 A modification of Potter's method for diagonal matrices with common unknown. I.Sheinman, G.J.Simitses (School of Engng. Sci. & Mech., Georgia Inst. of Technol., Atlanta, GA, USA).
Comput. & Struct. (GB), vol.18, no.2, p.273-5 (1984).
A solution methodology is presented for large systems of linear algebraic equations. In matrix form the submatrices are grouped along the diagonal (with at most three submatrices of varying order), except that there exists one nonvanishing column of submatrices. The algorithm is a modification of Potter's method and it is especially applicable to nonlinear buckling problems (limit-point instability). (5 refs.)

118451 Post buckling behaviour of transverse cracked columns. N.Anifantis, A.Dimarogonas (Machine Design Lab., Univ. of Patras, Patras, Greece).
Comput. & Struct. (GB), vol.18, no.2, p.351-6 (1984).
Post buckling behaviour of a column with a transverse surface crack on the one side is studied, considering the local flexibility because of the crack. This

flexibility, also called compliance is known to be related to the stress intensity factor. This relation is generalized and expressed in the form of a complete local stiffness matrix of the cracked section of the beam. The Paris equation for the deflection of cracked members is extended for this purpose to give the generalized influence coefficients, being considered as incremental deflections because of the presence of the crack. Eigenvalue solutions for the buckling load are developed which do not differ for appreciably slender columns from known solutions based on some only of the local flexibility coefficients reported in the literature. Moreover, two distinct buckling modes have been identified to closing cracks, because of the different behavior of the cracked region in compression and tension or positive and negative bending modes. The post buckling behavior has been studied, for both buckling modes solving numerically the nonlinear equation for the elastica with the local flexibilities because of the crack. (14 refs.)

118452 On stability of core-filled cylindrical shells under uniform external pressure. R.M.Bergman, A.E.Sapozhnikov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.1, p.58-63 (1983). In Russian.
The stability of a thin elastic closed cylindrical shell containing an elastic isotropic core under uniform external pressure was considered by a method of asymptotical analysis. The hinge boundary conditions for the shell and core were assumed. The shell stiffness as compared with the core stiffness and large-wave number in the direction of the shell guide were assumed to be much greater and very large correspondingly. The formulas derived in this article can be used to find critical forces. (6 refs.)

118453 Stability and optimization of viscoelastic cylindrical shells made out of composites under combined loading. V.Yu.Siryus, G.A.Teters (Inst. of Polymer Mech., Acad. of Sci., Riga, Latvian SSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.685-91 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.1021-8 (Nov.-Dec. 1982). [received: Sept. 1983]
The numerical investigation of the functions describing the physical restrictions in the problem of the optimization of cylindrical shells made out of composites with a viscoelastic binder carried out has shown that the optimization problem considered belongs to the class of convex programming problems. The parameters of the optimal design of the shell, i.e. the mass G^* and the relative fractions of the reinforcements θ_1, θ_2, arranged according to the corresponding schemes, are substantially dependent on the time for which the construction is utilized τ_{op}. A comparison of the optimal designs of a shell at the same utilization times τ_{op} has shown that the use of three-dimensional reinforcement schemes with an insignificant gain in mass provides a gain in the volume of the reinforcement in comparison with the planar reinforcement schemes of 22 to 24%. (10 refs.)

118454 Torsional stability of elastic rods. N.V.Nanichuk, A.A.Barsuk.
Mech. Solids (USA), vol.17, no.6, p.135-41 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.148-54 (1982). [received: Oct. 1983]
Investigates the stability of elastic rods loaded at the ends by concentrated moments, and the effect of distributed stiffness characteristics on the magnitudes of the critical moments. Within the framework of the static approach, for rods with the same bending stiffnesses in different planes, the effect of variability of the distributions of the bending stiffnesses along the rods on the critical values of the twisting moments at which loss of stability occurs is investigated. The solution of problems of stability under conditions of clamping of the edges of the rods is reduced to calculation of quadratures and determination of the roots of a system of two reduced to calculation of quadratures and determination of the roots of a system of two transcendental equations. For symmetrical stiffness distributions (relative to the center of the rods), determination of the eigenvalues reduces to solution of one transcendental equation. Specific examples are given. (8 refs.)

118455 On the stability of linear stochastic systems with periodically nonstationary parametric excitation. V.A.Semenov, A.I.Smirnov.
Mech. Solids (USA), vol.18, no.1, p.14-20 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.18, no.1, p.16-23 (1983).
Investigates the structure and configuration of the stability regions of linear stochastic systems in the case in which parametric excitation is a periodically nonstationary random process. The parametric excitation is specified by a multiplicative or additive representation of a deterministic periodic function of time and of some stationary random function with rational spectral density. The boundaries of the stability regions are constructed by using the method of movement functions jointly with the numerical method of Bolotin for investigating the solutions of linear differential equations with periodic coefficients. (6 refs.)

118456 Geometrical theory of stability of shells. A.L.Gol'denveizer.
Mech. Solids (USA), vol.18, no.1, p.135-45 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.18, no.1, p.143-54 (1983).
Discusses the possible effect that pseudobendings of the center surface (i.e. deformations that generalize bending and are in a sense similar to them) exert on the asymptotic behavior of the upper and lower critical loads of a thin elastic shell. The author offers a comparison with the results obtained within the framework of Pogorelov's geometrical theory of shell stability (1966), which is based on allowance for the effect of bendings. (12 refs.)

118457 Buckling of a heated thin non-homogeneous annular circular plate of variable thickness. J.Mukhopadhyay (Bohar High School, Burdwan, India).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.3, p.289-94 (May-June 1983). [received: Sept. 1983]
Deals with the buckling of a heated non-homogeneous annular circular plate of thickness varying as the *m*th power of the radial distance whereas Young's modulus varies as the *m*th power of the same. The general stability criterion has been obtained whence the critical buckling compression as well as the critical temperature have been calculated. (9 refs.)

118458 Buckling, postbuckling, and the flow through a tethered elastic cylinder under external pressure. C.Y.Wang (Depts. of Math. & Physiology, Michigan State Univ., East Lansing, MI, USA), L.T.Watson, M.P.Kamat.
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.13-18 (March 1983). [received: Oct. 1983]
A thin-walled elastic cylinder is tethered by numerous springs to an outer rigid cylinder. As external pressure is increased, the elastic cylinder will remain circular until a critical pressure difference is attained. The nonlinear governing equations for large deflections are formulated. The stability analysis shows the elastic cylinder may buckle with more than two circumferential waves due to the stiffness of the springs. Postbuckling shapes are integrated numerically by a quasiNewton method. The flow through such a partially collapsed shape is then computed by a finite element method. (16 refs.)

118459 Plastic buckling of initially imperfect stiffened cylinders in axial compression. G.A.Duffett, B.D.Reddy (Dept. of Civil Engng., Univ. of Cape Town, Rondebosch, S Africa).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.88-94 (March 1983). [received: Oct. 1983]
The behavior in the plastic range of axially compressed stringer-stiffened cylinders is investigated. The shell under consideration is assumed to have an initial imperfection in the form of sinusoidal deviation both axially and circumferentially. The constitutive relation employed here is J_2 deformation theory of plasticity. This relation, as well as kinematic assumptions regarding the behaviour of the panels and stiffeners that constitute the stiffened shell, is used in the principle of virtual work to obtain a set of nonlinear algebraic equations whose solution provides complete information about the prebuckling equilibrium path. This leads to an eigenvalue problem, the eigenvalue being the critical compressive load and the eigenfunction being the corresponding buckling mode. Results are presented for shells of different geometries and material properties, and a comparison of results is made with results obtained by others. The imperfect shells analyzed all exhibit stable behavior, with sufficiently large imperfections having a beneficial effect. Results for bifurcation from these paths are also discussed. (13 refs.)

118460 Buckling and postbuckling of a long-hanging elastic column due to a bottom load. C.Y.Wang (Dept. of Maths., Michigan State Univ., East Lansing, MI, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.2, p.311-14 (June 1983).
A long heavy elastic column is supported at the top end. The bottom end is subjected to a compressive force. The critical buckling loads, related to zeroes of Airy functions, are quite different from the Euler buckling loads. Postbuckling shapes are integrated numerically. (6 refs.)

118461 Instability analysis of pressure-loaded thin arches of arbitrary shape. T.Q.Ye (Northwestern Polytech. Univ., Xi'an, Shaanxi, China), R.H.Gallagher.
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.2, p.315-20 (June 1983).
The governing differential equations and the virtual work expressions for the large displacement analysis of thin arches of arbitrary shape, subjected to pressure loads, are derived. The virtual work expressions are employed as the basis for formulation of finite element stiffness equations. Classical solutions are obtained, from the differential equations, for the buckling of circular rings under uniform 'follower' (hydrostatic) and 'dead' (constant direction) pressure loadings. Finite element solutions are calculated for elliptical rings for a wide range of axis ratios. (10 refs.)

Optimal strength design of beam-columns .... See Entry 118398

Bifurcation of an elastic slab having inclined anisotropy-axes under axial loads .... See Entry 118410

Numerical optimum design of elastic annular plates with respect to buckling ... . See Entry 118412

A study on GRP skin/foam core sandwich structures .... See Entry 118413

The effect of a normal shock on the aeroelastic stability of a panel .... See Entry 118427

Visco-plastic large deformation analysis by finite element method and its applications. Inextensional deformation of thin-walled square tube .... See Entry 118428

A finite element method for elastic-plastic beams and columns at large deflections .... See Entry 118430

Compression failure of a unidirectional fibrous composite with an elastoplastic matrix .... See Entry 118441

Universal characteristic equations in problems of vibration and stability of elastic systems .... See Entry 118480

Experimental investigation of the stability of fiberglass cylindrical shells subject to prolonged application of twisting moments .... See Entry 120380

46.30M Vibrations, aeroelasticity, hydroelasticity, mechanical waves, and shocks

(see also 43.40 Mechanical vibrations and shock)

118462 Large-amplitude vibration of an initially stressed thick circular plate. Lien-Wen Chen, Ji-Liang Doong (Nat. Cheng-Kung Univ., Tainan, Taiwan).
AIAA J. (USA), vol.21, no.9, p.1317-24 (Sept. 1983).
Nonlinear equations of motion are derived for a transversely isotropic thick circular plate in a general state of nonuniform initial stress. The equations include the effects of transverse shear and rotary inertia. The large-amplitude flexural vibrations of simply supported and clamped thick circular plates subjected to initial stress are also investigated. The initial stress is taken to be a combination of pure bending stress plus an extensional stress in the plane of the plate. Nonlinear equations of motion are used to solve the vibration problems by the Galerkin method. In addition, the effects of various parameters on the nonlinear vibration frequencies are studied. (22 refs.)

118463 Optimization of cylindrically orthotropic circular plates including geometric nonlinearity with a constraint on the fundamental frequency. G.Venkateswara Rao, K.Kanaka Raju (Aerospace Structures Div., Vikram Sarabhai Space Center, Trivandrum, India).
Comput. & Struct. (GB), vol.18, no.2, p.301-5 (1984).
Optimization of cylindrically orthotropic circular plates is studied with a constraint on the fundamental frequency when the effect of geometric nonlinearity is included. Details of finite element formulation for inclusion of geometric nonlinearity, derivation of optimality criterion and recurrence relations are presented. Results for various values of orthotropy parameter are given in tables. (12 refs.)

118464 Elastic waves in heterogeneous rectangular clad rod. M.Touratier (Lab. de Structures, ENSAM, Paris, France).
J. Mec. Theor. & Appl. (France), vol.2, no.4, p.503-38 (1983). In French.
Elastic wave dispersion analysis is presented for a clad rod. The clad rod consists of a core of one material surrounded by a cladding material having different properties. The influence of cladding and core proportion on wave propagation is analysed for longitudinal and flexural-torsion motions. The conditions for obtaining guided propagation modes are explained, explicit geometrical conditions being Stonely waves at the interface. The model is compared with numerical and experimental results obtained for a homogeneous rod. (13 refs.)

118465 On wave shifts in fibre reinforced composite materials. V.T.Golovchan.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.32-4 (1983). In Ukrainian.
The problem is solved of elastic shear wave propagation in fibrous composites with a general type of regular structure for the arbitrary direction of pro-

pagation. The dispersion equation is an infinite convergent determinant. (2 refs.)

118466 Influence of finite initial deformations on the velocity of Rayleigh waves in an incompressible half-space. O.M.Bagno, V.P.Koshman.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.18-20 (1983). In Ukrainian.
The Rayleigh wave propagation in an incompressible half-space was studied in terms of a three-dimensional linearized theory of elasticity. A variance equation is obtained for an incompressible body whose elastic properties are described by an arbitrary elastic potential. The dependence of dimensionless phase velocity of the Rayleigh wave on the initial deformation value was numerically determined for a neo-Hookean body. (9 refs.)

118467 Structures for solving the problems in plate theory with mixed boundary conditions. V.L.Rvachov, L.V.Kurpa.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.33-5 (1983). In Ukrainian.
New structures are proposed for solution of bending and vibration problems for plates of an arbitrary shape with variable boundary conditions. The derivation of these formulas is based on the use of *R*-functions. (2 refs.)

118468 Bending vibration of a simply supported rectangular plate with a crack parallel to one edge. R.Solecki (Univ. of Connecticut, Storrs, CT, USA).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1111-18 (1983).
Natural flexural vibration of a simply supported rectangular plate with a symmetrically located crack parallel to one edge is considered. The problem is analyzed by means of finite Fourier transformation of discontinuous functions. The unknowns of the problem are the discontinuities of the displacement and of the slope across the crack. The singularities of the moments at the tips are 'built' in the solution. The conditional equations are obtained by satisfying the boundary conditions at the crack's edge. This requires differentiation of Fourier series representing a discontinuous function. The characteristic equation in form of an infinite determinant is obtained. Numerical data for certain geometries as well as comparison with existing results are included. (8 refs.)

118469 Plane waves in simple elastic solids and discontinuous dependence of solution on boundary conditions. Yongchi Li, T.C.T.Ting (Dept. of Civil Engng., Mech. & Metall., Univ. of Illinois, Chicago, IL, USA).
Int. J. Solids & Struct. (GB), vol.19, no.11, p.989-1008 (1983).
Using stress as the dependent variable instead of the deformation gradient, plane waves of finite amplitude in simple elastic solids are studied. For isotropic materials there are two plane polarized simple waves as well as shock waves and one circularly polarized simple wave which can also be regarded as a shockwave. With the aid of the stress paths for simple waves and shockwaves in the stress space introduced by the authors, one can see clearly what combination of simple waves and/or shockwaves is needed to satisfy the initial and boundary conditions. The authors use second order isotropic hyperelastic materials to illustrate the ideas. In one example the authors show that the solution requires as many as four simple waves. In another the authors show that depending on the boundary condition there are more than eight possible solutions to the problem. The authors also present an example in which the solution does not depend continuously on the boundary condition. This implies that in experiments if the applied load at the boundary is not properly controlled, any slight deviation in the applied load would result in a finite different response in the material. (14 refs.)

118470 Forced vibration of an anisotropic diaphragm with a concentric hole. G.C.D.Tyagi (Dept. of Math., DEI (Deemed), Dayalbagh.Univ.,Agra, India), G.C.Chadda.
Indian J. Pure & Appl. Math., vol.14, no.9, p.1118-37 (Sept. 1983).
The authors discuss the forced harmonic vibrations of a circular diaphragm of a homogeneous anisotropic elastic material of a particular type (reinforced concrete, Timoshenko and Wionowsky-Krieger, 1959) with a concentric, hole in response to the load field $q(r)e^{ipt}$. The technique of finite-Hankel transform is applied and behaviour of displacement field is analysed for $p=1$ and $p=\pi$ for the different values of t when $\bar{q}=0.713391, 1.5808828, 3.989238$, where $\bar{q}$ is the Hankel transform of $q(r)=q_0r^{m-1}$ for $m=1, 3, 5$. It is noted that for $p=1$ in the initial stage the displacement profiles are sinusoidal, but for large values of t they tend to become unimodal. Moreover, the displacements are comparatively larger near the inner edge. But when $p=\pi$, the displacements are larger near the outer edge and smaller near the inner edge. The case of isotropic medium is also compared with that of anisotropic medium graphically. (10 refs.)

118471 Vibration characteristics of self-expanding stayed columns for use in space. J.R.Banerjee, F.W.Williams (Dept. of Civil Engng. & Building Technol., Univ. of Wales Inst. of Sci. & Technol., Cardiff, Wales).
J. Sound & Vib. (GB), vol.90, no.2, p.245-61 (22 Sept. 1983).
The type of stayed column considered was developed by the ASTRO Research Corporation for NASA to evaluate, and is designed to be deployed in space after forming a light, compact package in the Space Shuttle. It consists of a core with three identical stay frames equally spaced around it. Each stay frame has a central compressed spoke with pretension stays which radiate from its end to the core. Three pretensioned battens connect the ends of the spokes. NASA performed vibration tests on a model of such a column and compared their results with approximate theoretical predictions. The authors give exact theoretical results, including natural frequencies and mode types not given in the NASA results. A substitute column method is used to achieve economy and a much deeper understanding of the modes. Approximations which give even greater economy and convenience are evaluated. A proposed design is analyzed alongside the NASA model. The proposed design is better than the NASA model because recent developments were implemented in the design method, and also because it has a graphite epoxy core whereas the NASA model had an aluminium one, due to temporary availability. (8 refs.)

118472 Dynamic response of a pre-stressed cylindrical shell to a moving load. K.Shirakawa (Dept. of Mech. Engng., Univ. of Osaka Prefecture, Osaka, Japan).
J. Sound & Vib. (GB), vol.90, no.2, p.263-73 (22 Sept. 1983).
The work presented is concerned with the response of a pre-stressed, finite, thin circular cylindrical shell under a moving local load with a constant velocity. An analysis is carried out by a dynamic method, and the solutions which are bounded even at the critical velocity are obtained. The effects of the initial stresses on the dynamic responses of the displacement and the stresses are examined in connection with the velocity of the load. (14 refs.)

118473 Free vibrations of a square plate symmetrically supported at four points on the diagonals. I.S.Raju (Vigyan Res. Associates Inc., Hampton, VA, USA), C.L.Amba-Rao.
J. Sound & Vib. (GB), vol.90, no.2, p.291-7 (22 Sept. 1983).
The purpose of this letter is threefold. The first is to present the first six symmetric-symmetric, antisymmetric-symmetric and antisymmetric-antisymmetric natural frequencies of a square plate resting on four point supports along the diagonals, as obtained by using finite element analysis. The second is to compare the present results with those of Gorman (1981), and the third is to attempt to clarify the discrepancies between the result of Venkateswara Ras et al. (1973) and Gorman (1981). (7 refs.)

118474 Eulerian formulation of transport equations for three-dimensional shock waves in simple elastic solids. T.C.T.Ting, Yongchi Li (Dept. of Civil Engng., Mech. & Metall., Univ. of Illinois, Chicago, IL, USA).
J. Elasticity (Netherlands), vol.13, no.3, p.295-310 (1983).
The propagation of a three-dimensional shock wave in an elastic solid is studied. The material is assumed to be a simple elastic solid in which the Cauchy stress depends on the deformation gradient only. It is shown that the growth or decay of a discontinuity ψ depends on (i) an unknown quantity ϕ^- behind the shock wave, (ii) the two principal curvatures of the shock surface, (iii) the gradient on the shock surface of the shock wave speeds and (iv) the inhomogeneous term which depends on the motion ahead of the shock surface and vanishes when the motion ahead of the shock surface is uniform. If a proper choice is made of the propagation vector b along which the growth or decay of the discontinuity is measured, the dependence on item (iii) can be avoided. However, b assumes different directions depending on the choice of discontinuity ψ with which one is concerned and the unknown quantity ϕ^- behind the shock wave on which one chooses to depend. As in the case of one-dimensional shock waves, the growth (or decay) of one discontinuity may not be accompanied by the growth (or decay) of other discontinuities. A universal equation relating the growth or decay of discontinuities in the normal stress, normal velocity and specific volume is also presented. (15 refs.)

118475 On the dissipation inequality in equilibrium shocks. C.Yatomi, N.Nishimura (Dept. of Aeronautical Engng., Kyoto Univ., Kyoto, Japan).
J. Elasticity (Netherlands), vol.13, no.3, p.311-16 (1983).
Presents expressions for the dissipation inequality corresponding to an equilibrium shock. These expressions are independent of the orientation of the shock. A sufficient condition on the constitutive equations for positive dissipation is given in the case of anti-plane deformations. (5 refs.)

118476 On the transverse vibration of a rubber string. M.F.Beatty, A.C.Chow (Dept. of Engng. Mech., Univ. of Kentucky, Lexington, KY, USA).
J. Elasticity (Netherlands), vol.13, no.3, p.317-44 (1983).
The nearly constant pitch of the sound radiated by a sufficiently stretched rubber cord, a phenomenon observed independently by two experimenters at the turn of the century, is explained analytically for three ideal rubberlike material models. Transverse vibrational frequency data for three kinds of rubber strings, obtained with the aid of a novel laser apparatus, are compared with the analytical results. A numerical scheme is introduced to compute from the experimental data the apparent average number of links in a molecular chain of a rubberlike material from both simple tension and transverse frequency measurements. It is shown that the nearly flat frequency response is a molecular network finite extensibility effect that is controlled by the apparent number of links in a chain of the molecular network structure. (10 refs.)

118477 Oscillations of a multilayer cylindrical panel with anisotropic layers under large deflections. B.A.Kiladze, I.N.Preobrazhenskii, A.Sh.Tskhvediani (Inst. of Subtropical Economy, Sukhumi, USSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.679-84 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.1014-20 (Nov.-Dec. 1982). [received: Sept. 1983]
The energy continualization method is applied to a multilayer shell with anisotropic layers. The derived equations are applied to the solutions of the problem of oscillations of a panel of a multilayer cylindrical shell under large transverse deflections. The amplitude-frequency response characteristics of such oscillations are found. A shell consisting of alternating anisotropic bearings and binding layers is examined. (7 refs.)

118478 Surface Love waves in orthotropic regularly layered composites. A.N.Podlipenets (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian USSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.734-7 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.1077-80 (Nov.-Dec. 1982). [received: Sept. 1983]
A solution of the problem of the propagation of LSW in orthotropic regularly layered composite materials is given, and the results of an analysis of the dispersion relations are presented. (6 refs.)

118479 Properties of a wave field in a semi-infinite elastic cylinder (boundary resonance). V.T.Grinchenko, V.V.Meleshko.
Mech. Solids (USA), vol.17, no.6, p.73-80 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.81-9 (1982). [received: Oct. 1983]
In considering forced wave motions in infinite and in particular in semi-infinite waveguides, a number of problems are encountered for which there are as yet no complete and clear-cut solutions. The authors offer some results that indicate the unusual nature of the response of a semi-infinite elastic cylinder to a nonaxisymmetric external load of the end face. (22 refs.)

118480 Universal characteristic equations in problems of vibration and stability of elastic systems. L.M.Zorii.
Mech. Solids (USA), vol.17, no.6, p.142-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.155-62 (1982). [received: Oct. 1983]
Develops a general method of setting up characteristic determinants that are universal for elastic systems, whose investigation can be reduced to one-dimensional problems. Some aspects of the development of the method of characteristic series are also considered. The method is applied to typical boundary-value problems for second-and fourth-order differential equations. The corresponding characteristic determinants of universal form are constructed and differential relations established between the functions they define. The author offers some examples of the use of universal equations in obtaining a number of working formulas. (12 refs.)

118481 Optimal longitudinal displacement of a rod. B.N.Sokolov.
Mech. Solids (USA), vol.17, no.6, p.149-55 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.163-70 (1982). [received: Oct. 1983]
The problem of optimal displacement of vibratory systems is investigated. The optimal longitudinal displacement of a rod by a prescribed distance with suppression of vibrations by means of a force applied to one of the end faces of the rod is considered. The optimality criterion is provided by a quadratic control function. (6 refs.)

118482 Combination resonances in systems with periodic parametric and random external excitation. M.F.Dimentberg, N.E.Isikov.
Mech. Solids (USA), vol.18, no.1, p.21-5 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.18, no.1, p.24-9 (1983).
Application of the averaging method to systems with periodically varying parameters acted upon by random external perturbations yields a system of shortened linear equations with constant coefficients in the slowly varying amplitudes of the vibrational processes. The authors employ the general method of analysis, described by Dimentberg et al. (1977), to make a detailed study of vibrational processes in a stable system with two degrees of freedom under conditions of sum or difference combination resonance. The results are employed, in particular, to identify combination parametric resonances in such systems. (5 refs.)

118483 Propagation of small perturbations in a system consisting of a prestressed compressible solid and a viscous compressible fluid. A.M.Bagno, A.N.Guz.
Mech. Solids (USA), vol.18, no.1, p.156-9 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.18, no.1, p.167-70 (1983).
Presents a method for investigating wave propagation in a hollow compressible cylinder that contains a viscous compressible fluid and is subjected to large (finite) initial deformations. (12 refs.)

118484 On interaction of thermo-acoustic waves with the progress of phase transition: a continuum approach. II. Growth and decay of thermo-acoustic waves. K.Tanaka (Univ. of Osaka Prefecture, Osaka, Japan), Y.Tanigawa.
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.4, p.357-66 (July-Aug. 1983).
For pt.I see ibid., vol.28, no.3, p.277 (1983). The growth and decay of thermo-acoustic waves travelling in thermoplastic materials in the process of phase transition is situated. The governing equation of the amplitude of the waves is derived. (5 refs.)

118485 SH waves in composite media under initial stresses. S.Dey, S.P.Mukherjee (Indian School of Mines, Dhanbad, India).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.4, p.387-93 (July-Aug. 1983).
Deals with the propagation of SH waves in composite media consisting of three layers of different rigidity and density under different initial stresses. The frequency equation giving the velocity of SH waves has been obtained in closed form. As particular cases, the frequency equations of Love waves having two superficial layers over a half space, with one superficial layer over a half space and in sandwiched layer between two half spaces all under initial stresses have been derived. An interesting discussion on the existence of Love waves depending upon the initial stresses is given. The results tally with the classical cases in the absence of initial stresses. (3 refs.)

118486 The influence of external and internal friction on the dissipative vibrations of straight bars. I.Constantinescu (Inst. de Mine Petrosani, Rumania).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.4, p.427-30 (July-Aug. 1983). In French.
Considering the external friction as proportional to speed, and introducing internal friction by use of Kelvin's viscoelastic body model, the author studies free and forced vibrations of straight bars with cross-sections of variable length. He concludes that the external friction damps particularly the low frequencies and internal friction the high ones, so that the presence of both types of friction plays the same role as the attenuating band-pass filter in electrotechnology. (6 refs.) *M.B.D.*

118487 On the radiation and diffraction of the two dimensional elastic waves in an infinite domain of homogeneous medium. M.Bessho (Dept. of Mech. Engng., Nat. Defense Acad., Yokosuka, Japan), H.Kawabe.
Sci. & Eng. Rep. Natl. Def. Acad. (Jpn.) (Japan), vol.20, no.4, p.343-81 (Dec. 1982). In Japanese. [received: Sept. 1983]
The theory of vibration of a solid body or a cavity in an infinite domain of elastic medium by in-coming plane waves is treated and summarized as follows: (i) some formulations of the boundary integral equation to solve its boundary value problem are discussed and proposed; (ii) the far field property is described introducing the so-called Kochin's function, that is the amplitude of radiating cyclindrical waves; (iii) the long wave approximations are identified to the static problem of elasticity; (iv) the reciprocity and the vibrational principle of boundary value problems are described; (v) the complex conjugates of the displacement or stress in the field are represented as the sum of the original vibration and diffraction term; (vi) formulating the equation of motion by making use of Haskind's relation the most favourable condition to absorb wave energy is obtained and its maximum absorbing sectional area of wave power is formulated; and (vii) various numerical examples are shown for a circular cylindrical boundary. (25 refs.)

118488 Interaction of a *P*-wave with a laterally stiffened slot. R.L.Ryan, S.Mall (Dept. of Mech. Engng., Univ. of Maine, Orono, ME, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.63-6 (March 1983). [received: Oct. 1983]
The interaction of a longitudinal wave with a narrow cavity or slot that contains an inclusion is considered. A singular integral equation is derived for the scattered field and the integral equation is solved numerically by a Gauss-Chebyshev technique. The stress intensity at the ends of the slot is obtained as a function of frequency and inclusion stiffness for both a continuous and discrete element inclusion. (10 refs.)

118489 Magnetoelastic plane waves in infinite rotating media. S.K.Roy Choudhuri (Dept. of Maths., Burdwan Univ., Burdwan, India), L.Debnath.
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.2, p.283-7 (June 1983).
A study is made of the propagation of magnetoelastic plane waves in an electrically conducting, infinite elastic solid permeated by a primary uniform magnetic field when the entire medium rotates with a constant angular velocity. A more general dispersion relation is obtained to investigate the effects of rotation and the external magnetic field on the phase velocity of the waves. This analysis reveals that when the applied magnetic field has both longitudinal and transverse components, the coupled magnetoelastic waves are dispersive and damped in an infinitely conducting medium in contrast to the nonrotating medium where the coupled waves are dispersive, but undamped. In the case of finite conductivity, the waves are dispersive and undamped in the absence of the applied magnetic field. At low frequency ω, the phase velocity of the waves varies as $\omega^{1/2}$ for finite conductivity, and is independent of the external magnetic field and rotation; while in the nonrotating case with low frequency (when the applied magnetic field has either longitudinal or transverse components) the phase speed is less than that in the rotating medium and is found to depend on the applied magnetic field. Also in both rotating and nonrotating cases, the phase velocity becomes very small for finitely conducting material with a very high magnetic permeability. (10 refs.)

Wave propagation near curvilinear boundaries of viscous piecewise homogeneous media ....See Entry 116998

Higher-order parabolic approximations to time-independent wave equations ....See Entry 116999

One procedure for inverting the Laplace transformation in problems of interaction between nonstationary waves and a spherical inclusion ...See Entry 118320

Flexural vibration of truncated elliptical cone and Chinese chime bells ....See Entry 118335

Motion of a material point under the action of a travelling sinusoidal wave ....See Entry 118381

On a problem of structural dynamics ....See Entry 118393

The effect of a normal shock on the aeroelastic stability of a panel ....See Entry 118427

Conservation laws for an elastic-viscoplastic medium with finite deformations ....See Entry 118443

Interaction of shear waves with two coplanar Griffith cracks situated in an infinitely long elastic strip ....See Entry 118506

Resonance controlled fatigue crack propagation in a beam under longitudinal vibrations ....See Entry 118507

Crack generated wave fronts ....See Entry 118510

Stationary subsonic motion of a cut in an elastic strip ....See Entry 118517

Interaction between a surface wave and a crack on a curvilinear surface ....See Entry 118522

Laser driven shock wave studies in single and double-layered slab targets ....See Entry 118742

Conditions at the rupture and spectra of the waves emitted by it ....See Entry 121131

Model studies of the elastic wave field and residual strains caused by a shear fault ....See Entry 121132

Calculation of the scalar wave field scattered by a sphere and an analysis of the images ....See Entry 121157

46.30N Fracture mechanics, fatigue, and cracks

118490 The fracture diagram: a new design tool for stiffened panels. M.M.Ghassem, T.P.Rich.
AIAA J. (USA), vol.21, no.9, p.1294-300 (Sept. 1983).
A detailed explanation is presented for the use of fracture diagram in the design of stiffened panels. Based upon some recent work on the development of fracture diagrams for a large sheet containing a crack midway between two parallel, riveted stiffeners, this paper emphasizes a methodology for employing fracture diagrams to estimate maximum loads, critical flaw sizes, and fatigue life for stiffened panels. In addition, the fracture diagram approach enables failure predictions to be made ranging from linear elastic rapid crack propagation to net section failure at the ultimate strength level of the material. The fracture diagrams are dimensionless and can be used for any material where meaningful yield strength and fracture toughness properties are available. References are provided for background and theoretical development of the fracture diagram approach. (14 refs.)

118491 Numerical and experimental study of stress concentration in elastic solids. M.A.Astiz Suarez, A.Valiente Cancho, M.Elices Calafat (Univ. Politecnica de Madrid, Madrid, Spain).
An. Fis. Ser. B (Spain), vol.79, no.2, p.65-76 (May-Aug. 1983). In Spanish. [received: Oct. 1983]
The stress concentration caused by notches on elastic bodies is an important topic in fracture mechanics. These stress concentrations are necessary to indicate fatigue cracking and hydrogen embrittlement. Numerical and experimental analysis are used to determine if the Creager and Paris stress field near a notch can describe the stress concentration in any notched body. Therefore, some interesting uses of this stress field in fracture mechanics are considered. (14 refs.)

118492 Determination of the crack stability parameters of materials using acoustic signal characteristics. O.E.Andreikiv, M.V.Lisak.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.25-7 (1983). In Ukrainian.
The subcritical crack propagation is investigated in an elastoplastic body under monotonic loading. The correlation is determined between acoustic emission signal and crack jump length and between stress intensity factor and total acoustic emission during subcritical growth of mode I crack. The analytical relationships are in good agreement with data from the literature. (8 refs.)

118493 Strain energy density fracture criterion in elastodynamic mixed mode crack propagation. M.Ramulu, A.S.Kobayashi (Dept. of Mech. Engng., Univ. of Washington, Seattle, WA, USA).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1087-98 (1983).
Sih's fracture criterion based on strain energy density, S, for mixed mode crack extension under static loading is extended to dynamic mixed mode, K_I, and K_{II}, crack propagation. Influence of the second order term, σ_{ox}, which represents the nonsingular constant stress acting parallel to the direction of crack propagation, on the S distribution surrounding the crack tip is demonstrated. Numerical studies show that positive σ_{ox} enhances the fracture angle and negative σ_{ox} reduces the fracture angle irrespective of the sign of K_{II}/K_I, when S is measured as a critical distance r_c from the crack tip. This fracture criterion is verified by the crack curving results of dynamic photoelastic fracture specimens. Omission of σ_{ox} term leads to predicted fracture angles which are at variance with experimental data. (28 refs.)

118494 Effects of crack growth on the load-displacement characteristics of precracked specimens under bending. T.-J.Chuang, L.Chuck, R.J.Fields, E.R.Fuller (Center for Materials Sci., NBS, Washington, DC, USA).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1099-109 (1983).
A critical evaluation of the feasibility of obtaining crack growth parameters from quasi-static bend tests is presented. First derived are the governing differential equations which characterize the time-history of bend test parameters for a given elastic material exhibiting power law crack growth behavior (ν-$\nu_{max}(K_I/K_{IC})$N). A numerical solution scheme is then developed which is capable of solving the initial value problem, thus quantitatively assessing the influence of crack growth on the load-displacement output. The results indicate that in order to calculate K_{IC} accurately based on the peak load data, the loading rate has to be set sufficiently fast compared to ν_{max} (but below dynamic rates), otherwise, it will generally overestimate its true value whenever slow crack growth occurs during the test; and that for high N materials the flexural test method gives a broad error band in N prediction and hence is not a reliable technique. However, it can be used by a designer

to quickly screen the new materials with high N values which are potential candidates for structural application. (10 refs.)

118495 The geometry dependence of the J_β curve for circumferential growth of through-wall cracks in cylindrical pipes subject to bending loads. E.Smith (Joint Manchester Univ./Univ. of Manchester Inst. of Sci. & Technol. Metall. Dept., Manchester, England).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1119-23 (1983).
Proceeding from the experimental observation that circumferential crack growth in circular cylindrical pipes subject to bending loads is associated with a constant crack tip opening angle, the J_R curve is predicted in terms of the pipe and crack prameters. The predictions compare favorably with experimental results for 4 in (~10 cm) diameter pipes containing cracks with different sizes. (5 refs.)

118496 Reinitiation of an arrested cleavage crack. A.R.Rosenfield, P.N.Mincer (Phys. Metall. Section, Battelle-Columbus Labs., Columbus, OH, USA).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1125-9 (1983).
Transverse-wedge-loaded compact specimens were used to measure the fracture toughness associated with reinitiation of an arrested cleavage crack. The data are consistent with more conventional measurements as well as large-cylinder thermal-shock results. It is suggested that this procedure can provide single-specimen crack-initiation and crack-arrest toughness. (10 refs.)

118497 Characteristics of brittle fracture under general combined modes including those under bi-axial tensile loads. Y.Ueda (Welding Res. Inst., Osaka Univ., Japan), K.Ikeda, T.Yao, M.Aoki.
Eng. Fract. Mech. (GB), vol.18, no.6, p.1131-58 (1983).
The brittle fracture initiation characteristics under general combination of the opening mode (Mode I), sliding mode (Mode II) and tearing mode (Mode III) were investigated both theoretically and experimentally. First, the perfectly brittle fracture tests were conducted on specimens of PMMA for all possible combinations of the fracture modes including respective pure modes. It was found that the $[G^k(\gamma)]_{max}$ or $[G(\gamma)]_{max}$ criterion was very effective to predict both the direction of initial crack propagation and the fracture strength. These energy release rates are expressed in closed forms, and the interaction curves of the brittle fracture strength under arbitrary combination of Modes I, II and III were derived. Next, for fracture accompanied by plastic deformation, tests were carried out on specimens of mild steel (SM 41) imposing bi-axial tensile loads at various low temperatures. Then, brittle fracture with plastic deformation occurs under a combination of Modes I and II. In the case of brittle fracture with small scale yielding, the $[G(\gamma)]_{max}$ criterion predicts well the direction of initial crack propagation but estimates only lower fracture strength than the experimental one. In the case of brittle fracture with large scale yielding and under general yielding, it was found from the fracture tests that the direction of initial crack propagation was nearly normal to the resultant vector of the crack opening displacements in the opening and sliding modes at the notch tip. (26 refs.)

118498 Crack growth resistance characterized by the strain energy density function. G.C.Sih, E.Madenci (Inst. of Fracture & Solid Mech., Lehigh Univ., Bethlehem, PA, USA).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1159-71 (1983).
Stable ductile fracture of a typical metal alloy is found to be governed by the condition dS/da=const., i.e. the rate change of the strain energy density S with crack length $2a$ (or a) remained constant. Since fracture and/or yielding are load rate dependent, the incremental theory of plasticity is employed for analyzing crack growth where unloading in the material near the crack can take place. Attention is focused on the energy per unit volume, dW/dV, stored along the prospective path of crack growth. The nearest neighbor continuum element must necessarily be at a finite distance r from the crack front. This leads to the general relation $dW/dV=S/R$. The critical value $(dW/dV)_c$ representing the area under the uniaxial true stress and strain curve is assumed to correspond with failure of material elements. If yielding and unloading occurred locally, a certain amount of irrecoverable energy will not be available for dissipation during macrocracking. Hence, the threshold energy density must be modified to read as $(dW/dV)_c^* < (dW/dV)_c$. The quantity $(dW/dV)_c^*$ may be regarded as the crack growth resistance whose magnitude decreases with increasing distance from the crack tip at which point yielding is most intensified. (11 refs.)

118499 Transition of Hertzian fracture to flexure fracture produced in glass plates by impact. Y.M.Tsai, Y.T.Chen (Dept. of Engng. Sci. & Mech., Iowa State Univ., Ames, IO, USA).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1185-90 (1983).
The strength and fracture of a glass plate in a three-dimensional state of stress produced by the transverse impact of a spherical body is investigated. The plate is supported by a ring foundation whose radius is comparable to the thickness of the plate. A general impact theory is developed to determine the critical stresses in the plate as a function of impact velocity, plate thickness, and support span. Impact experiments were carried out to measure the impact velocity required to fracture a glass plate specimen as function of support span. Hertzian fracture was observed at a short span of support whereas flexure fracture was observed at a larger support span. The impact velocity of fracture was measured to be increasing with increasing support span and its corresponding critical stress of fracture was also determined. (10 refs.)

118500 Simple bounds for the stress intensity factors by the method of singular integral equations. N.I.Ioakimidis (Chair of Maths B, School of Engng., Univ. of Patras, Patras, Greece).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1191-8 (1983).
The method of singular integral equations has become a classical method for solving plane and antiplane, static and dynamic crack problems in isotropic and anisotropic elasticity, particularly in cases where no closed-form solutions are available. Very simple methods are suggested for obtaining upper bounds for the stress intensity factors at the crack tips from the corresponding singular integral equation without solving this equation, even numerically, and with very few computations. Naturally, such a simplicity should lead to very conservative bounds and this is really the case. But, clearly, in a lot of practical cases such bounds are sufficient. Numerical results in simple crack problem show the efficiency of the proposed methods. (28 refs.)

118501 A remark on the solution of the integral equation of planar cracks in three-dimensional elasticity. N.I.Ioakimidis (School of Engng., Univ. of Patras, Patras, Greece).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1199-200 (1983).
It is proposed that the classical integral equation of a planar crack under normal loading in three-dimensional isotropic elasticity is solved after an integration with respect to the Laplace operator. Then this equation coincides with the fundamental equation of contact problems for an isotropic elastic half-space. The problem of an elliptical crack under a constant normal loading is solved by the present approach. (8 refs.)

118502 A note on the cracked plates reinforced by a line stiffener. O.S.Yahsi, F.Erdogan (Lehigh Univ., Bethlehem, PA, USA).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1211-15 (1983).
In this note the problem of a cracked plate reinforced reinforced by a line stiffener is reconsidered. The original solution of the problem was given by Greif and Sanders (1965). A variation of the problem with debonding between the plate and the stiffener near the cracked region was considered by Arin (1974). However, the special case of the problem in which the crack tip terminates at the stiffener does not appear to have been studied. In practice the solution may be necessary in order to assess the crack arrest effectiveness of the stiffener. (3 refs.)

118503 A cylindrical shell with an arbitrarily oriented crack. O.S.Yahsi, F.Erdogan (Lehigh Univ., Bethlehem, PA, USA).
Int. J. Solids & Struct. (GB), vol.19, no.11, p.955-72 (1983).
Considers the general problem of a shallow shell with constant curvatures. It is assumed that the shell contains an arbitrarily oriented through crack and the material is specially orthotropic. The nonsymmetric problem is solved for arbitrary self-equilibrating crack surface tractions which, added to an appropriate solution for an uncracked shell would give the result for a cracked shell under most general loading conditions. The problem is reduced to a system of five singular integral equations in a set of unknown functions representing relative displacements and rotations on the crack surfaces. The stress state around the crack tip is asymptotically analyzed and it is shown that the results are identical to those obtained from the two-dimensional in-plane and anti-plane elasticity solutions. The numerical results are given for a cylindrical shell containing an arbitrarily oriented through crack. Some sample results showing the effect of the Poisson's ratio and the material orthotropy are also presented. (16 refs.)

118504 A growth law for propagation of arbitrary shaped delaminations in layered plates. W.J.Bottega (Section of Appl. Math., Yale Univ., New Haven, CT, USA).
Int. J. Solids & Struct. (GB), vol.19, no.11, p.1009-17 (1983).
A growth law is derived which governs the propagation of a delamination embedded in a layered plate, with the shapes of the delaminated area and of the plate assumed to be arbitrary. The plate is considered to be subjected to edge loading. (3 refs.)

118505 Upper and lower bounds for energy-release rates in an elastic body. P.Rafalski (Inst. of Nuclear Res., Warsaw, Poland), A.Golebiewska-Herrmann.
Int. J. Solids & Struct. (GB), vol.19, no.11, p.1019-23 (1983).
A numerical method of evaluation of the energy-release increment resulting from the crack propagation in the elastic body is proposed. The method is based on the extremum principles established for the elastic-perfectly plastic body. An example of calculation of the upper and lower bounds for the energy released in edge-crack specimen is given. (2 refs.)

118506 Interaction of shear waves with two coplanar Griffith cracks situated in an infinitely long elastic strip. K.N.Srivastava, R.M.Palaiya, D.S.Karaulia (M.A. Coll. of Technol., Bhopal, India).
Int. J. Fract. (Netherlands), vol.23, no.1, p.3-14 (Sept. 1983).
In an earlier paper (see ibid., vol.21, p.39, 1983), the authors have studied the case of interaction of shear waves with a crack centrally situated in an infinite elastic strip; they now extend the study to the case of two coplanar Griffith cracks. An integral transform method is used to find the solution of the equation of motion from the linear theory for a homogeneous, isotropic-elastic material. This method resolves the problem into an integral equation. It has been observed that shear waves with frequencies less than a parameter depending on the width of the wave guide can only propagate. The integral equation is solved numerically for a range of values of wave frequency, width of strip and the inter-crack distance. These solutions are used to calculate the dynamic stress intensify factor. The results are shown graphically. (10 refs.)

118507 Resonance controlled fatigue crack propagation in a beam under longitudinal vibrations. A.J.Dentsoras, A.D.Dimarogonas (Machine Design Lab., Univ. of Patras, Patras, Greece).
Int. J. Fract. (Netherlands), vol.23, no.1, p.15-22 (Sept. 1983).
Fatigue crack growth in resonating members of distributed mass is studied under conditions of dynamic interaction between crack growth and crack load. The crack propagation rate is related to the stress intensity factor range by way of the well known power law. The depth of the crack determines the local flexibility due to crack which in turn influences the dynamic response of the system under an external force with constant amplitude and frequency. The propagating crack introduces additional flexibility to the continuous system which results in gradual shifting away of the resonance which results in smaller loading of the cracked section. This reduces, in general, the growth rate and brings eventually the system to a value of crack propagation rate below a conventional threshold rate which can be interpreted as dynamic crack arrest. Material damping is introduced through the use of complex modulus of elasticity and determines absolutely the crack growth rate in resonance, assuming that material damping is the dominant damping mechanism of the system. (16 refs.)

118508 The mechanics of splitting a strip through penetration with a sharp wedge. N.C.Huang (Dept. of Aerospace & Mech. Engng., Univ. of Notre Dame, Notre Dame, IN, USA).
Int. J. Fract. (Netherlands), vol.23, no.1, p.23-35 (Sept. 1983).
Deals with the mechanics involved in splitting a strip through penetration with a sharp wedge along the center line. First, a quasi-static problem is considered. The crack propagation can be associated with the loss in stability when the applied load reaches the critical value for bifurcation. Next, the static problem is extended to a dynamic case by including the inertia force of the wedge in the analysis. An initial value problem is formulated for the motion of the wedge. For any given weight of the wedge, the critical velocity of the wedge for indefinite crack propagation can be determined by means of the theory of dynamic stability. Finally, the case of splitting a strip under repeated applications of impulsive load is considered. The critical number of applications of impulsive load for indefinite crack propagation is determined numerically. (9 refs.)

118509 Why do cracks avoid each other?. S.Melin (Div. of Solid Mech., Lund Inst. of Technol., Lund, Sweden).
Int. J. Fract. (Netherlands), vol.23, no.1, p.37-45 (Sept. 1983).
The experimentally known phenomenon that originally collinear mode I cracks seem to avoid each other before coalescence is studied by investigating the stability of straight crack paths. To this end a periodic array of approximately collinear but slightly curved cracks is considered. Stress intensity factors for modes I and II are derived and the growth of originally straight cracks under mode I conditions is studied after introduction of a disturbance that forces the cracks to deviate from a straight path. It is shown that the straight crack path is unstable, i.e. that tip to tip coalescence will not take place. (9 refs.)

118510 Crack generated wave fronts. H.Cohen, S.J.Matysiak (Dept. of Civil Engng., Univ. of Manitoba, Winnipeg, Canada).
Int. J. Fract. (Netherlands), vol.23, no.1, p.61-9 (Sept. 1983).
Considers cracks of a fixed size and shape which exist in an unbounded linear elastic body. The crack faces are assumed to suffer a sudden disturbance, which results in a shock wave emanating from the region of the crack into the body. The geometry and physics are assumed such as to give rise to problems governed by the equations of two-dimensional elastodynamics. For a crack of finite length, two approaches are utilized to find the shape of the wave front which will propagate into a body with homogeneous material properties. For a semi-infinite crack an analogous problem is solved, but in this case for a body with nonhomogeneous cylindrically symmetric material properties. The authors conclude with a heuristic discussion of the corresponding situation within the framework of three-dimensional elastodynamics. (6 refs.)

118511 Distribution function of dislocations and condition of finite stress for the dislocation-free zone model of fracture. S.-J.Chang (Engng. Technol. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA), S.M.Ohr.
Int. J. Fract. (Netherlands), vol.23, no.1, p.R3-10 (Sept. 1983).
In order to investigate the role of the dislocation-free zone in crack tip processes, the authors have extended the Bilby-Cottrell-Swinden (BCS) theory of fracture to treat the problem of elastic-plastic cracks in terms of an equilibrium distribution of dislocations. A singular integral equation was formulated and the distribution function of dislocations was obtained in terms of elliptic integrals. (5 refs.)

118512 Viscoelastic crack growth.
Int. J. Fract. (Netherlands), vol.23, no.1, p.R11-13 (Sept. 1983).
Examines the crucial aspects of the arguments concerning the role of conservation of energy in viscoelastic crack kinetics. It is shown that the different points of view can be reconciled, and a unified explanation for kinetic effects is given. (6 refs.)

118513 Contour integral around a crack at the root of a step loaded in antiplane strain. W.S.Blackburn, J.N.Swingler (Sci. Services Dept., CEGB, Gravesend, England).
Int. J. Fract. (Netherlands), vol.23, no.1, p.R15-21 (Sept. 1983).
The plastic zone size and crack tip opening displacement are calculated at the tip of the crack at the root of a sharp step of arbitrary angle loaded in anti-plane strain. A semi-infinite region of elastic, perfectly plastic material is assumed containing a step and having the component of stress normal to the zone made equal to the yield stress. (1 ref.)

118514 The geometry dependence of the J_R curve for the growth of a deep crack in a solid subjected to bending deformation. E.Smith (Metall. Dept., Univ. of Manchester, Inst. of Sci. & Technol., Manchester, England).
Int. J. Fract. (Netherlands), vol.23, no.1, p.R29-32 (Sept. 1983).
Compares results from the model by Tada, Paris and Ganoble (1979) which uses a simple representation of plasticity, with those of the more realistic model by Rice, Drugan and Sham (1980). There are close similarities implying that the simple approach may be used in reasonable confidence as regards its predictions. (14 refs.)

118515 Large deformations near a tip of an interface-crack between two Neo-Hookean sheets. J.K.Knowles, E.Sternberg (Div. of Engng. & Appl. Sci., California Inst. of Technol., Pasadena, CA, USA).
J. Elasticity (Netherlands), vol.13, no.3, p.257-93 (1983).
Contains an asymptotic investigation—within the nonlinear theory of elastostatic plane stress—of the deformations and stresses near the tips of a traction-free interface-crack between two dissimilar semi-infinite Neo-Hookean sheets. The results obtained are free of oscillatory singularities of the kind predicted by the linearized theory, which would require the two deformed faces of an interface-crack to overlap in the vicinity of its tips. Instead, the crack is found to open smoothly near its ends, regardless of the specific loading at infinity. (18 refs.)

118516 Stress redistribution in a ruptured fiber of a viscoelastic composite. M.B.Pobedrya (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.663-8 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR),* vol.18, no.6, p.995-1001 (Nov.-Dec. 1982). [received: Sept. 1983]
States the dynamic and quasistatic problem concerning stress redistribution in a fibrous composite, the fibers and matrix of which are a linear viscoelastic material (generally speaking, different), where one of the fibers has failed. An approximate solution is derived for arbitrary relaxation centers of the matrix and fibers using the Sheperi method. (11 refs.)

118517 Stationary subsonic motion of a cut in an elastic strip. I.V.Simonov.
Mech. Solids (USA), vol.17, no.6, p.81-90 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela,* vol.17, no.6, p.90-9 (1982). [received: Oct. 1983]
Investigates the properties of the wave field in an elastic strip with a semi-infinite cut. Cases are considered in which the edge of the cut moves in two directions, corresponding to the problem of oblique collision of plates and to the problem of propagation of a crack under a stationary load. Using the Fourier transformation, the problem is reduced to a generalized Riemann problem. The factorization method is used to obtain a solution that contains arbitrary constants, which are determined from the conditions at singular points. The author discusses differences between his results and previous results which correspond to versions of the same problem, but with energy sources at singular points. The possibility of crack propagation with super-Rayleigh velocity with a load of varying sign is considered. An estimate is offered for the magnitude of the tensile stresses on the continuation of the crack in the collision problem. (24 refs.)

118518 Brittle fracture under creep. A.A.Vakulenko,Jr..
Mech. Solids (USA), vol.17, no.6, p.107-12 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela,* vol.17, no.6, p.117-23 (1982). [received: Oct. 1983]
A variety of recent experiments indicate that the change in density of metal specimens under creep frequently runs as high as 1-2%. In view of this, it has been proposed that the damage parameter be provided by the relative change in density $(\rho-\rho_0)/\rho_0$. Obviously , since $\rho=\rho_0(1+\epsilon_v)^{-1}$, where ϵ_v is the relative change in volume, the damage parameter can be provided by ϵ_v (or by a suitable function of this quantity) with equal success. In this case the entire characteristic pattern of the longevity as a function of the stress level under creep for a rod acted upon by a fixed tensile force follows from one clear-cut experimental fact. Even more important, with this choice of the damage parameter it is possible to develop, in a fairly simple way, the foundations of a statistical approach to quasi-brittle fracture under creep. (14 refs.)

118519 Stress redistribution in a rupturing fiber as it peels away from a viscoelastic matrix of composition material. V.V.Moskvitin, V.V.Moskvitin.
Mech. Solids (USA), vol.18, no.1, p.106-11 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela,* vol.18, no.1, p.114-19 (1983).
As a rule, rupture of a fiber in a composition material is accompanied by a peeling away of some portion of the ruptured fiber from the matrix. A nonlinear long-term strength condition is introduced as the peeling criterion. The model of the material that is employed makes it possible to investigate dynamic stress redistribution in the process of peeling away of a viscoelastic matrix from a fiber. (5 refs.)

118520 Bounds and approximate formulas in the problem of a plane normal-separation crack in elasticity. R.V.Gol'dshtein, E.I.Shifrin.
Mech. Solids (USA), vol.18, no.1, p.112-19 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela,* vol.18, no.1, p.120-7 (1983).
The authors construct two approximate formulas for the volume of a crack occupying a convex region that satisfies the conditions outlined by Polya and Szego (1962). One expresses the volume in terms of the area of G and the torsional stiffness of a rod with cross section G; the other expresses the volume in terms of the area of the region and the length of the contour that bounds it. In addition, an approximate formula is proposed for determining the stress intensity coefficient in terms of the coefficient in the asymptotic form at the boundary of the region of the torsion function. Finally, the bounds and approximate formulas for the crack volume, in combination with the bound established earlier by Gol'dshtein et al. (1981) in terms of the volume of a crack with maximum stress intensity coefficient (N_{max}) along the crack contour, yield fairly efficient lower bounds for N_{max}. These bounds provide sufficient conditions for crack propagation. (9 refs.)

118521 On the problem of thermal failure under rapid heating. S.A.Shesterikov, M.A.Yumasheva.
Mech. Solids (USA), vol.18, no.1, p.120-7 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela,* vol.18, no.1, p.128-35 (1983).
Under certain heating conditions, it is possible to observe a fracture effect for times comparable to the heating time; and in some cases fracture is possible after the action of the heat source has been removed. The authors make a detailed analysis of the process of thermal failure of an element of elastic-brittle material, also with allowance for plastic properties, using the example of a beam of which one web is heated instantaneously to a prescribed temperature. (3 refs.)

118522 Interaction between a surface wave and a crack on a curvilinear surface. I.S.Guz.
Mech. Solids (USA), vol.18, no.1, p.160-4 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela,* vol.18, no.1, p.171-5 (1983).
Allowing for the fact that cracks are frequently encountered on curvilinear surfaces in practice, and that the curvature affects the stress distribution in the surface wave, the author examines the interaction between a surface wave and a crack on a convex surface. (4 refs.)

118523 On the estimation of energy release rates. R.Abeyaratne (Coll. of Engng., Michigan State Univ., East Lansing, MI, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.19-23 (March 1983). [received: Oct. 1983]
The energy release rate associated with the Mode I and Mode III crack problems for an infinite, nonlinearly elastic, incompressible body are estimated. The calculation adopts an approximation that is a natural extension of the small-scale yielding concept to problems involving moderate levels of loading. The results are compared with available exact and numerical solutions and the agreement is found to be remarkably good. The scheme used here, based on the theory of small deformations superposed on a finite deformation, can be utilized to estimate the energy release rate in many other crack problems. (16 refs.)

118524 Thermal stress in a transversely isotropic medium containing a penny-shaped crack. Y.M.Tsai (Dept. of Engng. Sci. & Mech., Iowa State Univ., Ames, IA, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.24-8 (March 1983). [received: Oct. 1983]
The thermal stress problem for a penny-shaped crack contained in a transversely isotropic medium is investigated using the techniques of Hankel transforms and double integrations. Symmetrical thermal loadings are applied over the crack surfaces. For constant temperature and heat flux over the crack surfaces, expressions for the crack shapes and the thermal stresses in the crack plane are obtained in closed forms. The stress intensity factors are also obtained and shown to be dependent on the material properties. (11 refs.)

118525 The penny-shaped interface crack with heat flow. I. Perfect contact. C.J.Martin-Moran (Dept. of Mech. Engng., Univ. of Newcastle upon-Tyne, Newcastle upon Tyne, England), J.R.Barber, M.Comninou.
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.29-36 (March 1983). [received: Oct. 1983]
A solution is given for the thermal stresses due to a penny-shaped crack at the interface between dissimilar materials loaded in tension for the case where the heat flux is into the material with higher distortivity. Regions of separation and perfect thermal contact are developed at the crack faces. A harmonic potential function representation is used to reduce the problem to a three-part boundary value problem which is formulated as a pair of coupled Abel integral equations using the method of Green and Collins. These equations are further reduced to a single Fredholm equation which is solved numerically. Results are presented illustrating the effect of heat flux and applied tractions on the contact radius and the stress intensity factors for various combinations of material constants. The effect of heat flux is profoundly influenced by the relative signs of Dundurs constant β and a constant γ describing the mismatch of distortivities. If the more distortive material is also the more rigid, the contact region at the crack face is reduced by heat flow; otherwise it is increased. In the latter case, solutions involving separation are obtained even for applied compressive tractions if the latter is within a certain range. (20 refs.)

118526 Axisymmetric singular stresses in a thick-walled spherical shell with an internal edge crack. A.Atsumi, Y.Shindo (Dept. of Mech. Engng. II, Tohoku Univ., Sendai, Japan).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.37-42 (March 1983). [received: Oct. 1983]
Considers the elastostatic axisymmetric problem for a thick-walled spherical shell containing a circumferential edge crack on the inner surface. The ring-shaped edge crack and the inner surface of the spherical shell are subjected to internal pressure. Using an integral transform technique the authors obtained a singular integral equation of the first kind which has a generalized Cauchy kernel as the dominant part. The integral equation is solved numerically, and the influence of the geometrical configuration on the stress-intensity factor and the crack-opening displacement is shown graphically in detail. (9 refs.)

118527 Stress distributions for a quarter plane containing an arbitrarily oriented crack. L.M.Keer, J.C.Lee, T.Mura (Dept. of Civil Engng., Northwestern Univ., Evanston, IL, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.43-9 (March 1983). [received: Oct. 1983]
A solution for an elastic quarter plane containing an arbitrarily oriented crack is presented. The problem is formulated by means of Mellin integral transforms and reduced to a system of two coupled singular integral equations where the unknown quantities are the dislocation densities that characterize the crack. Numerical solutions are investigated for various orientations of the cracks. In each case the stress intensity factors are computed for the different parameters. (6 refs.)

118528 Dynamic singular stresses for a Griffith crack in a soft ferromagnetic elastic solid subjected to a uniform magnetic field. Y.Shindo (Dept. of Mech. Engng., Tohoku Univ., Sendai, Japan).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.50-6 (March 1983). [received: Oct. 1983]
The problem of the diffraction of normally incident longitudinal waves on a Griffith crack located in an infinite soft ferromagnetic elastic solid is considered. It is assumed that the solid is a homogeneous and isotropic one and is permeated by a uniform magnetostatic field normal to the crack surfaces. Fourier transforms are used to reduce the problem to two simultaneous dual integral equations. The solution to the integral equations is expressed in terms of a Fredholm integral equation of the second kind having the kernel that is a finite integral. The dynamic singular stress field near the crack tip is obtained and the influence of the magnetic field on the dynamic stress intensity factor is shown graphically in detail. Approximate analytical expressions valid at low frequencies are also obtained and the range of validity of these expressions is examined. (12 refs.)

Carrying capacity of fibre bundles with varying strength and stiffness .... See Entry 118395

Axisymmetric problem for elastic medium with a spherical inclusion weakened by a crack at the interphase boundary .... See Entry 118396

The plastic η factor for a deeply cracked beam with tension of the small remaining ligament .... See Entry 118437

Deformation of materials with defects .... See Entry 118445

Bending vibration of a simply supported rectangular plate with a crack parallel to one edge .... See Entry 118468

Application of a new velocity gage to fraction at high crack velocities .... See Entry 118537

A fracture mechanics study of the fatigue of rubber in compression .... See Entry 119093

Study of the relationship between fracture toughness (J_{IC}) and bulge ductility .... See Entry 120403

Quasi-brittle fracture of specimens with a cutout in the form of a line .... See Entry 120427

Micromechanical failure predictions for polymer-matrix composites .... See Entry 120441

The effects of aqueous chemical environments on crack and hydraulic fracture propagation and morphologies .... See Entry 121224

46.30P Friction, wear, adherence, hardness, mechanical contacts

118529 Finite element analysis of steadily moving contact fields. J.Padovan, S.Tovichakchaikul (Dept. of Mech. Engng., Univ. of Akron, Akron, OH, USA), I.Zeid.
Comput. & Struct. (GB), vol.18, no.2, p.191-200 (1984).
By introducing a moving updated Langrangian observer, this paper develops traveling finite elements with the capacity to handle the global response resulting from steadily moving contact fields. The generality of the results is such that large deformation kinematics and kinetics as well as the full compliment of inertial fields can be handled. To streamline the handling of nonlinear behaviour, an elliptically constrained solution algorithm is also developed. Employing this algorithm, the results of several numerical benchmarking studies are presented which illustrate the capacity of the moving updated Lagrangian formulation as well as the potential effects of nonlinearity. (46 refs.)

118530 Contact problem for elastic bodies with circular boundaries at the onset of wear. M.I.Teplii.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.36-40 (1983). In Ukrainian.
An effective approach is suggested to solution of a problem on internal compression of elastic cylindrical bodies with wear. The solution is given for the case of a nonlinear law of wear. Formulas are found for determining the contact angle, contact pressure and wear of contiguous bodies. (4 refs.)

118531 Adhesive contact of sectionally smooth-ended punches on elastic half-spaces: theory and experiment. D.Maugis, M.Barquins (Lab. Central des Ponts et Chaussees, CNRS, Paris, France).
J. Phys. D (GB), vol.16, no.10, p.1843-74 (14 Oct. 1983).
Attractive molecular forces give rise to singular tensile stresses and to a discontinuity of displacement at the edge of contacts. These boundary conditions are those of fracture mechanics and correspond to adding a rigid body displacement to the classical elastic solution. The adhesive contact of sectionally smooth-ended punches (sphere or cone) is studied. Stress distribution, shape of the deformed surface, and relation between load and penetration are given either for equilibrium or kinetic conditions. For a flat-ended sphere, the adherence of a flat punch and the JKR theory for sphere are obtained as particular cases; for zero surface energy systems, the solution reduces to that of Ejike. The case of a sphere with a spherical cap of different radius and that of a rounded cone are also examined. Experimental verification has been performed with a glass ball (R=2.19 mm and flats between 100 and 240 μm radius) on polyurethane. Radii of contact, penetration and kinetics of detachment agree with the theory within 2%. (17 refs.)

118532 Problem of intersection of two half-planes with reinforced edges. B.V.Kalashnikov, Yu.I.Kudishin.
Mech. Solids (USA), vol.18, no.1, p.66-74 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela,* vol.18, no.1, p.73-81 (1983).
By employing the method of linear conjugation the authors solve a contact problem of elasticity. The principal singular integral equation on a semiinfinite interval is solved by an approximate method based on the use of Laguerre polynomials. The authors investigate the behaviour of the unknown function at the zero point and at a point at an infinite distance, and aspects of numerical implementation of the method. As an example, calculations are performed for a crane girder. Theoretical results are compared with experimental data. (6 refs.)

118533 One solution of the contact problem of nonlinear steady creep for a half-plane. V.M.Aleksandrov, M.A.Sumbatyan.
Mech. Solids (USA), vol.18, no.1, p.99-105 (1983). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela,* vol.18, no.1, p.107-13 (1983).
Proposes a new approach to the contact problem of indentation of a rigid die into a half-plane whose material is under conditions of steady power-law creep. The approach is based on joining the solution valid in the entire region except for the neighborhood of the corners of the die to the solution valid near the corners. The authors determine the sizes of the zones of the 'local' and 'global' solutions, and obtain the relationship between the indenting force and the settling of the die. (7 refs.)

118534 Nonlocal and nonlinear friction laws and variational principles for contact problems in elasticity. J.T.Oden, E.B.Pires (Dept. of Aerospace Engng. & Engng. Mech., Univ. of Texas, Austin, TX, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.67-76 (March 1983). [received: Oct. 1983]
The use of the classical Coulomb law of friction in the formulation of contact problems in elasticity leads to both physical and mathematical difficulties; the former arises from the fact that this law provides a poor model of frictional stresses at points on metallic surfaces in contat, and the latter is due to the fact that the existence of solutions of the governing equations can be proved only for very special situations. Nonclassical friction laws are proposed in an attempt to overcome both of these difficulties. The authors consider a class of contact problems involving the equilibrium of linearly elastic bodies in contact on surfaces on which nonlocal and nonlinear friction laws are assumed to hold. The physics of friction between metallic bodies in contact is discussed and arguments in support of the theory are presented. Variational principles for boundary-value problems in elasticity in which such nonlinear nonlocal laws hold are then developed. A brief discussion of the questions of existence and uniqueness of solutions to the nonlocal and nonlinear problems is given. (12 refs.)

Creep of thin shells interacting with rigid bodies .... See Entry 118435

Transition of Hertzian fracture to flexure fracture produced in glass plates by impact .... See Entry 118499

Large deformations near a tip of an interface-crack between two Neo-Hookean sheets .... See Entry 118515

Impact experiments on ice .... See Entry 121560

46.30R Measurement methods and techniques

(see also 07.10 Mechanical instruments and techniques, 81.70 Materials testing)

118535 Further developments in in-plane strain measurement of rotating structures. R.W.T.Preater (Dept. of Mech. Engng., City Univ., London, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.591-4 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
An experimental technique which combines the accuracy of holographic interferometry and the ease of a television video display which may be used under service conditions for in-plane strain measurement is extremely attractive. Electronic speckle pattern interferometry (ESPI) is a technique which displays this potential and development for application to rotating structures is at present taking place at The City University. The latest results achieved showing interference fringes recorded at tangential velocities up to nearly 5 ms^{-1} are presented. (4 refs.)

118536 Effect of specimen thickness on Mode I stress intensity factor in photoelastic investigations. N.Srinivasa Murthy, N.Rakesh, L.S.Srinath (Dept. of Mech. Engng., Indian Inst. of Sci., Bangalore, India).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1201-5 (1983).
Reports results pertaining to the acceptable thickness of slice necessary to obtain a satisfactory value for stress intensity factors from photoelastic data, and to the domain within which the observed photoelastic data give reasonably consistent values for stress intensity factors. (5 refs.)

118537 Application of a new velocity gage to fraction at high crack velocities. P.Beguelin, B.Stalder, H.H.Kausch (Lab. de Polymeres, Ecole Polytech. Federale de Lausanne, Lausanne, Switzerland).
Int. J. Fract. (Netherlands), vol.23, no.1, p.R7-10 (Sept. 1983).
A new velocity gage has been described by Stalder et al., (see ibid., vol.22, p.R47, 1983), which uses a layer of graphite particles applied by spraying and bound by two silver electrodes. The general possibilities offered by the new gage in impact loading studies are discussed. (5 refs.)

118538 Modal balancing of flexible rotors without test runs: an experimental investigation. P.Gnielka (Inst. fur Luft- und Raumfahrt, Tech. Univ. Berlin, Berlin, Germany).
J. Sound & Vib. (GB), vol.90, no.2, p.157-72 (22 Sept. 1983).
In all methods of balancing flexible rotors currently in use (modal balancing and influence coefficient techniques) test masses and test runs are required for the calculation of correctiom masses. In the modal balancing procedure suggested by Gasch and Drechsler [1978] a simple identification method is used to find the generalized unbalances without test runs. The Gasch and Drechsler balancing procedure is reported and extended to multibearing rotors with initial shaft bow. Systematic experiments done on two test rotors are described. The results show that flexible shafts mounted in ball bearings can be balanced with very good results. Even rotors in fluid film bearings, exceeding the scope of modal theory, were balanced with good results. (13 refs.)

118539 Predicting the creep of unidirectional reinforced plastic with thermorheologically simple structural components. R.D.Maksimov, E.Z.Plume (Inst. of Polymer Mech., Acad. of Sci., Riga, Latvian SSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.737-44 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR),* vol.18, no.6, p.1081-9 (Nov.-Dec. 1982). [received: Sept. 1983]
Investigates the possibility of the staged prediction of the viscoelastic properties of a composite, the structural components of which can be considered thermorheologically simple bodies: first to perform accelerated tests on the components and to predict their viscoelastic properties, and then, using prediction data and structural models, to determine by computational means the long-term viscoelastic properties of the composite with allowance for the structure of the reinforcement. (17 refs.)

118540 On a curvature based non-destructive moire technique for detecting defects in plates. G.Subramanian, S.Krishnakumar (Dept. of Aeronaut. Engng., India Inst. of Technol., Madras, India).
NDT Int. (GB), vol.16, no.5, p.271-4 (Oct. 1983).
Curvature contouring of laterally loaded reflective plates is shown to be an effective means of detecting defects. A sensitive moire method is proposed which uses an image-shearing technique to obtain at the image plane a dense slope-modulated virtual grating which, when superposed upon itself with a lateral shift, yields explicit partial curvature fringes. The method enables the determination of the location and also the size and shape of the defect. (6 refs.)

118541 Holographic interferometry in vibration measurements. P.Hynna. **Report 185**, Tech. Res. Centre Finland, Occupational Safety Eng. Lab., Espoo (May 1983), 91 pp. In Finnish.
The aim of the literature review was to consider the use of holographic interferometry in vibration measurements. Holographic interferometry is interferometric comparison of two or more waves, at least one of which is holographically reconstructed. At the beginning of this review basic optics and holography, which are needed to describe holographic interferometry, are presented. Vibration measurement in the case of sinusoidal vibration, separable motions, multiple motions and nonseparable motions are presented. Real-time and stroboscopic holographic interferometry, temporally modulated holography, the use of sandwich-holograms in vibration measurements and the measurement of vibration phase are considered. The optical image derotation developed to study rotating objects is presented. Speckle photography and speckle interferometry, which are nearly related and complementary to holographic interferometry, are discussed. Basic features of industrial applications and equipment are presented and safety risks of lasers are briefly discussed. (100 refs.)

Statistical errors for non-linear system measurements involving square-law operations .... See Entry 117142

Basic study on foil strain gauges made of electrodeposited copper or nickel .... See Entry 117159

On the transverse vibration of a rubber string .... See Entry 118476

Application of instrumented impact testing for studying dynamic fracture behaviour of rotor steels .... See Entry 120521

Planning and statistical processing of the results of tests for plotting quantile fatigue curves .... See Entry 120525

Method of investigating the rules of deformation and failure under conditions of low-cycle nonisothermal loading .... See Entry 120526

Device for tensile testing of brittle materials .... See Entry 120528

Residual stress measurements by means of neutron diffraction .... See Entry 120530

Some informational aspects of the experimental determination of the viscoelastic characteristics of polymeric materials .... See Entry 120541

New strain standards for glassware stress photoelastic evaluation .... See Entry 120542

A tracking device for stabilizing the pressure of a transducer on a workpiece during scanning .... See Entry 120558

Residual stresses in plastics pipes .... See Entry 120590

46.60 RHEOLOGY OF FLUIDS AND PASTES

118542 Rheological properties of nonaqueous polystyrene dispersions. Z.T.Il'ina, I.A.Ageeva, M.T.Bryk (Inst. of Colloid Chem. & of the Chem. of Water, Acad. of Sci., Kiev, Ukrainian SSR).
Colloid J. USSR (USA), vol.44, no.6, p.916-20 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1039-43 (Nov.-Dec. 1982). [received: Sept. 1983]
Substantial differences in the rheological behavior of polystyrene dispersions prepared by different methods have been established. It is shown that the lyophilization of the surface of dispersed particles of polystyrene obtained by polymerization is attributable to the entrapment of silicone rubber macromolecules by the polystyrene particles during their nucleation and growth. (5 refs.)

118543 Master surfaces of viscoelastic functions in the reciprocal temperature-frequency space. I. Basic considerations. M.-J.Brekner, H.-J.Cantow, H.A.Schneider (Inst. fur Makromoleculare Chem., Univ. Freiburg, Freiburg, Germany).
Polym. Bull. (Germany), vol.10, no.7-8, p.328-35 (Sept. 1983).
Starting from Eyring's transition state theory (1941) it is demonstrated for systems obeying the superposition principle that the frequency shift factors of isotherm mastercurves of the viscoelastic functions as well as the temperature shift factors of the isochrone ones are unequivocally interrelated with the apparent activation energy of flow. The method for the evaluation of the activation energy from viscoelastic data is discussed, considering the moduli surfaces in the reciprocal temperature-frequency space. Experimental data prove the reliability of the approach. It is demonstrated that it is much more suitable to construct mastercurves as well as master surfaces in this way, because it is not necessary to apply measurements at low frequencies, which are unavoidable when the curves are constructed by empirical shift in the usual way. (7 refs.)

The effect of addition of suspension PVC and VC-VAc copolymers on the rheological properties of modified PVC plastisols .... See Entry 119252

Structural and mechanical properties of polydisperse suspensions of electrocorundum .... See Entry 120678

47.00 FLUID DYNAMICS

(for fluid dynamics of quantum fluids, see 67.; for geophysical fluid dynamics, see 92.10; for astrophysical gas dynamics, see 95.30; for biological fluid dynamics, see 87.45)

47.10 GENERAL THEORY

(see also 03.40G Mathematical aspects)

118544 Numerical experiments with the Osher upwind scheme for the Euler equations. S.R.Chakravarthy (Stanford Univ., Stanford, CA, USA), S.Osher.
AIAA J. (USA), vol.21, no.9, p.1241-8 (Sept. 1983).
The Osher algorithm for solving the Euler equations is an upwind finite difference procedure that is derived by combining the salient features of the theory of conservation laws and the mathematical theory of characteristics for hyperbolic systems of equations. A first-order accurate version of the numerical method was derived by Osher circa 1980 for the one-dimensional nonisentropic Euler equations in Cartesian coordinates. In this paper, the extension of the scheme to arbitrary two-dimensional geometries is explained. Results are then presented for several example problems in one and two dimensions. Future work will include extension of the method to second-order accuracy and the development of implicit time differencing for the Osher algorithm. (20 refs.)

118545 Mathematical models and computing algorithms for the flow of a viscous fluid. N.N.Yanenko.
Cybernetics (USA), vol.18, no.6, p.715-22 (Nov.-Dec. 1982). Translation of: *Kibernetika (USSR)*, vol.18, no.6, p.17-22 (Nov.-Dec. 1982). [received: Sept. 1983]
Describes the mathematical characteristics of Navier-Stokes equations in cartesian coordinates. Also discussed is the correspondence between the structure of a total algorithm and the architecture of a computer. (15 refs.)

118546 Hydrodynamic and mass transfer characteristics of polypropylene multifilament wire gauze packings. K.Niranjan, V.G.Pangarkar (Dept. of Chem. Technol., Univ. of Bombay, Bombay, India).
Chem. Eng. J. (Switzerland), vol.27, no.1, p.49-57 (Aug. 1983).
Hydrodynamic and mass transfer characteristics of regular polypropylene multifilament wire gauze packings are presented. These packings can be conveniently used to handle corrosive systems. The gas side pressure drop and static and dynamic holdup values were determined for an air-water system. The theory of gas absorption accompanied by a pseudo-mth-order reaction was used to determine the values of the effective interfacial area a, the liquid side mass transfer coefficient k_La and the gas side mass transfer coefficient k_Ga. The values of a are strongly influenced by the type of distributor used. With an improved liquid distributor, a relatively good turndown is obtained. The a values are almost double the a values for conventional packings. True k_L values appear to be higher than those for conventional packings because of increased turbulence caused by the packings. The k_La and k_G a data were correlated with V_L and V_G. (18 refs.)

118547 The well-posedness of two-dimensional ideal flow. C.Sulem, P.Sulem (Dept. de Math., Univ. de Nice, Nice, France).
J. Mec. Theor. & Appl. (France), spec, suppl., p.217-42 (1983).
Presents a review of mathematical results concerning well-posedness of the Euler equation for an ideal fluid in two dimensions. When the vorticity is initially bounded (in Holder norm), there exists for all time a unique solution which remains as smooth as the initial data (Wolibner, 1933). This condition is not satisfied in the context of the Kelvin-Helmholtz instability where the initial velocity is discontinuous through a vortex sheet. In the latter case, existence for a short time of the vortex sheet is ensured only if the sheet and the vorticity density are initially analytic. Asymptotic analysis (Moore, 1979) and numerical simulations (Meiron, Baker and Orszag, 1982) suggest that a singularity in the vortex sheet develops in a finite time. Existence of the flow at all times is then ensured only in a weak sense. The emphasis is on an elementary presentation of the methods. The authors have tried to bring out the cores of the proofs (mainly a priori estimates), leaving out some technical details. (50 refs.)

118548 On integrals and invariants for inviscid, irrotational flow under gravity. M.S.Longuet-Higgins (Dept. of Appl. Maths. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
J. Fluid Mech. (GB), vol.134, p.155-9 (Sept. 1983).
Simplified proofs are given of the eight basic conservation laws for two-dimensional irrotational flow of a perfect fluid. The corresponding relations for rotational flow are also discussed. (3 refs.)

118549 Grain flow as a fluid-mechanical phenomenon. P.K.Haff (Div. of Phys., Maths. & Astron., California Inst. of Technol., Pasadena, CA, USA).
J. Fluid Mech. (GB), vol.134, p.401-30 (Sept. 1983).
The behaviour of granular material in motion is studied from a continuum point of view. In so far as possible, individual grains are treated as the 'molecules' of a granular 'fluid'. Besides the obvious contrast in shape, size and mass, a key difference between true molecules and grains is that collisions of the latter are inevitably inelastic. This, together with the fact that the fluctuation velocity may be comparable to the flow velocity, necessitates explicit incorporation of the energy equation, in addition to the continuity and momentum equations, into the theoretical description. Simple 'microscopic' kinetic models are invoked for deriving expressions for the 'coefficients' of viscosity, thermal diffusivity and energy absorption due to collisions. The 'coefficients' are not constants, but are functions of the local state of the medium, and therefore depend on the local 'temperature' and density. In general the resulting equations are nonlinear and coupled. However, in the limit $s \ll d$, where s is the mean separation between neighbouring grain surfaces and d is a grain diameter, the above equations become linear and can be solved analytically. (19 refs.)

118550 Potential flow around two dimensional isosceles triangular cylinder subjected to uniform flow from base surface. T.Nagashima (Dept. of Aeronautical Engng., Nat. Defense Acad., Yokosuka, Japan), T.Hirose.
Sci. & Eng. Rep. Natl. Def. Acad. (Jpn.) (Japan), vol.20, no.4, p.435-42 (Dec. 1982). In Japanese. [received: Sept. 1983]
The theoretical velocity distribution of an ideal flow around the isosceles triangular cylinder subjected to uniform flow from its base surface is presented by using the conformal mapping method developed by Lighthill (1945) and Hay (1956). The velocity distribution is very different from the one for actual flow in which flow separations from edges predominate; however, it still provides a useful reference for experimental investigations. (3 refs.)

Perturbation procedures for nonlinear viscous flows .... See Entry 118639

Reciprocity theorems for a nonuniform medium .... See Entry 118660

47.15 LAMINAR FLOWS

118551 The two-dimensional laminar wake with initial asymmetry. A.Demetriades (Montana State Univ., Bozeman, MT, USA).
AIAA J. (USA), vol.21, no.9, p.1347-9 (Sept. 1983).
A frequent problem in laser cavity flows, airfoil aerodynamics, and similar two-dimensional fluid problems is the mixing of two identical uniform, compressible streams past a sharp trailing edge (TE) of a partition, on one side of which the laminar boundary layer is thicker than it is on the other. Since the streams are identical this configuration resembles an ordinary two-dimensional wake; however, the disparity in the boundary-layer thicknesses is bound to introduce asymmetries in the flow, especially beyond but near the trailing edge. The distance beyond the latter over which such asymmetries persist is of significance, especially if no restrictions are placed on the flow Mach number M_e and the temperature ratio T_w/T_{oe} of the solid partition relative to the stagnation temperature of the stream. The author aims at presenting formulas valid for such an asymmetric wake for any M_e and T_w/T_{oe} and any degree of asymmetry introduced via the ratio $P=\theta_1/\theta_2$, where θ is the boundary-layer momentum thickness at the trailing edge and subscripts 1 and 2 refer to the two sides of the partition. (7 refs.)

118552 An interferometric investigation of separated forced convection in laminar flow past cavities. W.Aung (Dept. of Mech. Engng., Howard Univ., Washington, DC, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.505-12 (Aug. 1983).
This study concerns the separated, laminar forced convection in cavities located on a flat plate in a low-speed wind tunnel. Temperature profiles and local heat transfer coefficients are measured by means of a Mach-Zehnder interferometer. With all walls maintained at a uniform temperature, experiments are conducted for cavity aspect ratios (length divided by depth) $w/s=4$ and $w/s=1$ at different Reynolds numbers. Results show that the temperature distribution outside of the cavity is little influenced by flow in the cavity. The local heat transfer distribution on the cavity floor attains a maximum value that is located between the midpoint of the cavity floor and the downstream wall. Everywhere on the cavity floor, the local heat transfer is substantially less than the value upstream of the cavity. Compared with attached flow obtained by setting the cavity depth to zero, the average heat transfer on the cavity floor is more than a factor of two lower for $w/s=4$ and more than an order of magnitude lower for $w/s=1$. (17 refs.)

Noise generated by airfoil profiles placed in a uniform laminar flow .... See Entry 118327

Heat transfer mechanisms and performance in multiple parallel disk assemblies .... See Entry 118578

Laminar natural convection in an inclined rectangular box with the lower surface half-heated and half-insulated .... See Entry 118588

Finite analytic numerical solution axisymmetric Navier-Stokes and energy equations .... See Entry 118599

Boundary layers on characteristic surfaces for time-dependent rotating flows .... See Entry 118616

Diffusive, electrostatic, and gravitational deposition of suspensions in the entrance of a nozzle .... See Entry 118665

Flow characteristics in the curved rectangular channels. Visualization of secondary flow .... See Entry 118689

Nonequilibrium radiative heating of an ablating Jovian entry probe .... See Entry 121496

A finite-volume, adaptive grid algorithm applied to planetary entry flowfields .... See Entry 121583

47.15C Laminar boundary layers

118553 The final approach to steady state in an axisymmetric stagnation flow following a change in free stream velocity. R.S.R.Gorla (Dept. of Mech. Engng., Cleveland State Univ., Cleveland, OH, USA).
Appl. Sci. Res. (Netherlands), vol.40, no.3, p.247-51 (1983).
The authors problem concerns with the boundary layer flow of an incompressible fluid in the vicinity of an axisymmetric stagnation point for a variation with time of the free stream such that the inviscid flow is steady after some given finite instant of time. An investigation is made of the development of steady flow in the viscous region after this given instant. (8 refs.)

118554 The asymptotic solutions of compressible, nonsteady boundary layer. M.Alexandrescu (Nat. Inst. for Sci. & Tech. Creation, Bucharest, Rumania).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.3, p.235-43 (May-June 1983). [received: Sept. 1983]
Presents the method of matching asymptotic expansions to study laminar viscous compressible flow in the axisymmetric two-dimensional case. (4 refs.)

Unsteady incompressible flow at a three-dimensional stagnation point with large injection rates .... See Entry 118559

Onset of convection in a horizontal layer of cold water .... See Entry 118593

Variable fluid property effects on transport in pure water around the density extremum .... See Entry 118601

The 'whistler-nozzle' phenomenon .... See Entry 118652

Plane jet interaction with three-dimensional disturbances .... See Entry 118653

On transverse secondary flows in wave channels .... See Entry 118680

47.15F Stability of laminar flows

Unified approach to the solution of problems of unsteady laminar flow in long pipes .... See Entry 118678

47.20 HYDRODYNAMIC STABILITY

118555 A discrete vortex simulation of Kelvin-Helmholtz instability. I.G.Bromilow, R.R.Clements (Univ. of Bristol, Bristol, England).
AIAA J. (USA), vol.21, no.9, p.1345-7 (Sept. 1983).
At the interface between two flows of different density and velocity, there is a generation of vorticity which must be included when calculating the development of the interface. In the past, models have been presented which include a time variation of vorticity due to buoyancy and/or surface tension effects but the resulting numerical schemes were either complicated or else limited the development of the vortex sheet to early times. Zalosh (1976) applied the discrete vortex method to the study of Kelvin-Helmholtz instability. This technique approximates a continuous distribution of vorticity by a set of discrete vortices, whose subsequent motion enables the motion of the vortex sheet to be inferred. The singularity in the velocity field of a point vortex is associated with a growing randomness of the discrete vortices with their close approach. According to Zalosh, this was responsible for the inaccuracies in his calculations. The authors have presented techniques for reducing this irregular movement. (10 refs.)

118556 Finite amplitude evolution of mixing layers in the presence of solid boundaries. P.Huerre (Dept. of Aerospace Engng., Univ. of Southern California, Los Angeles, CA, USA).
J. Mec. Theor. & Appl. (France), spec, suppl., p.121-45 (1983).
The linear and nonlinear stability theory of two-dimensional free shear layers is briefly reviewed. The author then analyses in detail the situation where an antisymmetric velocity profile is bounded by parallel solid walls. If δ denotes the ratio of the separation distance between the two walls and the thickness of the layer, the flow first becomes linearly unstable at zero wavenumber above a certain critical value δ_c. The author shows that the nature of the amplitude equation governing the nonlinear development of long-wavelength instability waves around δ_c depends on the order of magnitude of the critical layer Reynolds number R_{cl}. In the viscous critical layer regime ($R_{cl}\ll 1$), the evolution equation is integro-differential and reflects the nonanalyticity of the dispersion relation at zero wavenumber. In the purely nonlinear critical layer regime ($R_{cl}=\infty$), the evolution equation reduces to the Boussinesq equation. Although the underlying dispersion relations are different in each case, both equations admit identical solitary wave solutions. (48 refs.)

118557 Instabilities of a cylindrical liquid sheet between two gas streams. J.Martinon (Ecole Nat. Superieure des Mines de Paris, Paris, France).
J. Mec. Theor. & Appl. (France), vol.2, no.4, p.629-41 (1983). In French.
Presents results on the linear stability of a cylindrical liquid sheet between two gas streams, when the three velocity fields have both axial and tangential components. For a given wavenumber in the axial direction, the pulsation of a perturbation with period $2\pi/n$ in the tangential direction must satisfy a fourth degree equation with real coefficients. Detailed results are given for thin sheets; only the difference between gas velocity fields influence the stability. For small tangential component difference values, the dominant instability is axisymmetric, but this is no longer the case when this difference is more important. (10 refs.)

118558 Numerical solution of a Rayleigh-Taylor instability problem. J.Geydanus, H.Rasmussen (Dept. of Appl. Math., Univ. of Western Ontario, London, Ontario, Canada).
J. Comput. & Appl. Math. (Netherlands), vol.9, no.2, p.97-103 (June 1983).
The numerical solution of a Rayleigh-Taylor instability problem where an inviscid liquid of finite depth is accelerated into a gas of semi-infinite extent is obtained by transforming the irregular flow domain into a rectangular domain by a coordinate transformation. The free surface equation is solved by a Crank-Nicholson procedure. The boundary condition at the free surface for the velocity potential ϕ which contains the time derivative of ϕ is also treated by an implicit scheme. The numerical results agree well with those obtained by higher order perturbation analysis. (7 refs.)

118559 Unsteady incompressible flow at a three-dimensional stagnation point with large injection rates. C.D.Surma Devi, G.Nath (Dept. of Appl. Math., Indian Inst. of Sci., Bangalore, India).
Indian J. Technol., vol.21, no.3, p.94-100 (March 1983). [received: Oct. 1983]
The self-similar solution of the unsteady laminar incompressible boundary-layer flow at a three-dimensional stagnation point for both nodal and saddle point regions has been obtained when the free stream velocity and the square of the mass transfer (injection) vary inversely as a linear function of time. The equations governing the flow have been solved numerically using an implicit finite-difference scheme in combination with the quasilinearization technique for nodal points of attachment but employing parametric differentiation technique instead of quasilinearization for saddle points of attachment. The unsteadiness in the free stream velocity is found to have strong influence on both the velocity and temperature fields, but Prandtl number affects only the temperature field and large Prandtl number gives rise to temperature overshoot in the saddle-point region in the presence of large injection. The velocity component in the y direction shows flow reversal in the saddle point region for accelerating flow but both flow reversal and velocity overshoot for decelerating flow, and the region of reverse flow increases with injection rate. Also, the dividing streamline is pushed away from the boundary due to injection. (27 refs.)

118560 A numerical method for potential flows with a free surface. A.Prosperetti (Istituto di Fisica, Univ. di Milano, Milano, Italy), J.W.Jacobs.
J. Comput. Phys. (USA), vol.51, no.3, p.365-86 (Sept. 1983).
A finite-difference numerical method for an accurate and efficient solution of transient potential flow problems with a free surface is described and illustrated with application to the Rayleigh-Taylor instability and the expulsion of liquid from a pipe immersed in a tank. The novel feature of the method consists of the adoption of special differentiation formulae to calculate the liquid velocity at the free surface with much greater accuracy and stability than previously possible. (26 refs.)

118561 Spinning modes on axisymmetric jets. I. P.J.R.Strange, D.G.Crighton (Dept. of Appl. Math. Studies, Univ. of Leeds, Leeds, England).
J. Fluid Mech. (GB), vol.134, p.231-45 (Sept. 1983).
Linear instability analysis is applied to the slowly diverging mean profile of a turbulent axisymmetric jet and used to predict the transverse structure and axial evolution of large-scale wavelike modes with azimuthal wavenumber $m=1$. Comparisons are made with measurements of filtered velocity fluctuations, and of pressure fluctuations, taken in a jet with coherent forcing at the exit plane, at Strouhal numbers $St=fD/U_0$ around 0.5, $f=\omega/2\pi$ being the frequency, D the nozzle diameter and U_0 the mean centreline exit velocity. The transverse structure at each axial station is well predicted by linear theory, as is the phase speed and its variation with axial distance. The downstream evolution of amplitude is much less well predicted, presumably because of cumulative nonlinear effects in the experiments, though the inclusion of mean-flow divergence itself constitutes a significant improvement over the theory for parallel flow. (26 refs.)

The final stage of decay of turbulence in stably stratified fluid .... See Entry 118574

Convection driven by concentration- and temperature-dependent surface tension .... See Entry 118587

Numerical study of transient high Rayleigh number convection in an attic-shaped porous layer .... See Entry 118595

The structure of turbulence in homogeneous and stratified rotating fluids .... See Entry 118607

Flow between rotating disks. II. Stability .... See Entry 118611

Nonlinear stability conditions and a priori estimates for barotropic hydrodynamics .... See Entry 118628

Nonlinear unstable wave disturbances in fluidized beds ....See Entry 118669

Stability of convection rolls in the presence of a horizontal magnetic field ....See Entry 118686

The flow around an oscillating sphere. II. The measurement of unsteady drag ....See Entry 118690

Elastic deformations and electrohydrodynamic instabilities in large pitch cholesteric liquid crystals under an electric field .... See Entry 119083

Continuous mode in the theory of the barotropic instability of zonal flows ....See Entry 121336

47.25 TURBULENT FLOWS, CONVECTION, AND HEAT TRANSFER

118562 Introduction to two-dimensional turbulence. M.Lesieur (Inst. de Mecanique de Grenoble, Grenoble, France).
J. Mec. Theor. & Appl. (France), spec, suppl., p.5-20 (1983). In French.
After discussing the validity of the concept of two-dimensional turbulence the author examines conditions under which a quasitwo-dimensional turbulence may be obtained; flows submitted to a rapid rotation, such as large scale atmosphere and oceanic motions, MHD flows submitted to a strong magnetic field, mixing layers, and stratified flows. A brief review of spectral theories of forced two-dimensional turbulence is presented, with a discussion about the notion of negative eddy-viscosity. The author then looks at the dynamics of a freely-evolving turbulence, without any injection of energy due to external forces. In the latter case the author discusses the concept of an enstrophy 'pseudo-catastrophe' at a finite time, introduced by Tatsumi and Vanase (1981). This time could be related to the time after which a mixing layer flow becomes three-dimensional in the small scales. Finally it is shown through quasigeostrophic theory how the interaction of Rossby waves and turbulence could explain the zonal structure of the Jovian atmosphere. (34 refs.)

118563 The prevalence of two-dimensional motion in the turbulent mixing layer. G.M.Corcos (Dept. of Mech. Engng., Univ. of California, Berkeley, CA, USA).
J. Mec. Theor. & Appl. (France), spec, suppl., p.147-67 (1983).
Experimental evidence suggests that in the turbulent mixing layer the fundamental mechanism of growth is two-dimensional and little affected by the presence of vigorous three-dimensional motion. To quantify this apparent property and study the growth of streamwise vorticity, the author represents the velocity field as: $\underline{V}(\underline{x},t)=\underline{U}(x,z,t)+\underline{u}(x,y,z,t)$ where $\underline{U}$ is two-dimensional and $\underline{u}$ is three-dimensional. In a first version of the problem $\underline{U}$ is independent of $\underline{u}$ while in the second $\underline{U}$ is the spanwise average of $\underline{V}$. In both cases the equation for $\underline{u}$ is linearized around $\underline{U}$. The equations for $\underline{U}$ and $\underline{u}$ are solved simultaneously by a finite difference calculation starting with a slightly disturbed parallel shear layer. The solutions offer details of the growth of the three-dimensional motion, and show that its energy is narrowly localized. Comparison of the two cases shows that even large amplitude three-dimensional motions have a negligible effect on the rate of coalescence of the spanwise vortices and thus on the growth of layer. (12 refs.)

118564 Modelling of virtual scales in numerical simulation of two dimensional turbulent flows. C.Basdevant, R.Sadourny (Lab. de Meteorologie Dynamique, Ecole Normale Superieure, Paris, France).
J. Mec. Theor. & Appl. (France), spec, suppl., p.243-69 (1983). In French.
Strictly speaking, direct numerical simulation of turbulent flows necessitates a mesh size of the order of the dissipation scale. Therefore, only comparatively low Reynolds numbers can be attained. However, if one admits that the structure of turbulent flows at macroscales is independent of the deterministic behaviour of dissipative microstructures, one can hope to simulate it using relatively low-resolution models, provided that the statistical effect of subgrid scales on resolved scales is adequately modelled. In the case of a two-dimensional turbulence model with a cut-off wavenumber in the enstrophy-cascading range, this subgridscale modelling is essentialy reducible to a proper representation of the cascade process. The classical approach is to use non-linear diffusion operators more or less heuristically defined. More recently, statistical methods involving the classical phenomenological theory of the inertial range have been proposed. A major drawback of the latter approach is its dependence on a tentative phenomenological model. The authors show that the occurrence of intermittency in two-dimensional turbulence must lead to a different phenomenology, involving spectral slopes markedly steeper that those expected from the classical theory. In view of this uncertainty concerning the choice of a proper phenomenological model, the authors come to the conclusion that subgridscale modelling should be based on generic properties of the original equation. Two different approaches following this strategy are presented. (21 refs.)

118565 'Statistical helicity invariant' and decay of inertial turbulence. A.Frenkel, E.Levich (Inst. of Appl. Chem. Phys., City Univ. of New York, New York, NY, USA).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.25-7 (3 Oct. 1983).
A new ('three-range-spectrum') model is suggested for freely evolving homogeneous turbulence with high Reynolds numbers, in connection with the recently shown (approximate) conservation of density of mean-square helicity. The corresponding power law of energy decay is slower than in conventional two-range models. (11 refs.)

118566 Fractional analysis of Reynolds stress distribution in complex shear flows. H.Dumitrescu, S.T.N.Savulescu (Increst, Bucharest, Rumania).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.2, p.139-57 (March-April 1983). [received: Sept. 1983]
Following their theory (1981) the authors analyze the relation $u'\eta'=\nu_T{}^{\delta U}/_{\delta y}$ for the complex shear flows involving separation, relaxation (recirculating) flows. Physically ν_T-distribution scales with h-distribution even in such flows. A new expression for $h^*(U_a)$ was proposed which agrees with experimental data for nearly equilibrium flows. Concerning the value of ν_{Tmax} in these complex flows, especially in the reattaching region, it strikingly deviates from the values of equilibrium shear layers. (9 refs.)

Mathematical models and computing algorithms for the flow of a viscous fluid ....See Entry 118545

The structure of turbulence in homogeneous and stratified rotating fluids ....See Entry 118607

The mixing layer: an example of quasi two-dimensional turbulence ....See Entry 118608

k-ϵ equation for compressible reciprocating engine flow ....See Entry 118627

Effect of pipe diameter on polymer drag reduction ....See Entry 118644

Plane jet interaction with three-dimensional disturbances ...... See Entry 118653

Two-dimensional behaviour of MHD fully developed turbulence ($Rm \gg 1$) ....See Entry 118684

47.25C Isotropic turbulence

118567 Prediction of separated asymmetric trailing-edge flows at transonic mach numbers. C.C.Horstmann (NASA Ames Res. Center, Moffett Field, CA, USA).
AIAA J. (USA), vol.21, no.9, p.1255-61 (Sept. 1983).
Numerical simulations of the time-dependent, Reynolds-averaged, Navier-Stokes equations, employing various eddy viscosity turbulence models are presented and compared with measurements from an investigation of a transonic trailing-edge flow at a high Reynolds number. Comparisons are made for mean surface quantities as well as mean and fluctuating flowfield quantities. Solutions employing two-equation turbulence models correctly predict all the major features of the flowfield. Viscous/inviscid interaction effects were found to be extremely important for predicting this flowfield and equally important to the turbulence modelling employed. (17 refs.)

118568 Boundary-layer and turbulence intensity measurements in a shock wave/boundary-layer interaction. S.Raghunathan, R.J.W.McAdam (Queen's Univ. of Belfast, Belfast, N Ireland).
AIAA J. (USA), vol.21, no.9, p.1349-50 (Sept. 1983).
Previous work by the authors has shown that attached turbulent boundary layers at zero pressure gradient are sensitive to the freestream turbulence. The effect of freestream turbulence on the boundary layer at positive pressure gradients is very little understood. The authors investigate the influence of freestream turbulence on shock induced separation. (6 refs.)

118569 Influence of two-dimensional turbulence on diffusion. M.Larcheveque (Lab. de Meteorologie Dynamique, Ecole Normale Superieure, Paris, France).
J. Mec. Theor. & Appl. (France), spec, suppl., p.271-92 (1983). In French.
The authors show that the laws about contaminant cloud diffusion on particle pair dispersion in a forced stationary two-dimensional turbulence are still valid for free-decaying two-dimensional turbulence. Experimental diffusion measurements in quasi two-dimensional turbulent flows satisfy these laws and a numerical value for a universal diffusion constant is proposed. Some conjectures about the predictability of free-decaying two-dimensional turbulent flows are deduced from these diffusion laws. A brief comparison is made with the three-dimensional case. (51 refs.)

118570 Multiple scale concept in turbulence modelling. II. Reynolds stresses and turbulent fluxes of a passive scalar, algebraic modelling and simplified models using the Boussinesq hypothesis. R.Schiestel (Inst. de Mecanique Statistique de la Turbulence, Marseille, France).
J. Mec. Theor. & Appl. (France), vol.2, no.4, p.601-28 (1983). In French.
For pt.I see ibid., vol.2, no.3, p.417 (1983). Modelling of Reynolds stresses and turbulent fluxes of a passive scalar contaminant is studied using multiple scales concepts. The analysis introduced in part I, which was based on the spectral equations in homogeneous anisotropic turbulence, is extended and completed. Interpretation in physical space is also considered. Algebraic multiscale modeling possibilities are examined along with a simplified model based on the Boussinesq hypothesis of eddy viscosity. To illustrate the method, the problem of turbulent transfer is treated for two very different situations: turbulent free jets and heat diffusion in grid turbulence. (22 refs.)

118571 Turbulence induced change in the conformation of polymer molecules. R.Armstrong, M.S.Jhon (Dept. of Chem. Engng., Carnegie-Mellon Univ., Pittsburgh, PA, USA).
J. Chem. Phys. (USA), vol.79, no.6, p.3143-7 (15 Sept. 1983).
An investigation into the conformation of a polymer molecule exposed to a stochastic flow field is made utilizing a cumulant expansion. The study begins by considering the full Kirkwood-Riseman *n*-bead chain with an arbitrary connector potential as a model for the polymer molecule, digressing to the two-bead dumbbell molecule for detailed calculations. It is found that the effect of the stochastic velocity field on the molecule can be interpreted as a 'renormalization' of the connector potential. The introduction of this renormalized potential greatly simplifies the mathematics and lends an intuitive understanding to the effect of the turbulence on the polymer. It is shown that this analysis will recover the anomalous tendency of the radius of gyration to become infinite for the special case of a Hookean potential which has been observed by previous investigators. Further, this study involves the Eulerian velocity-velocity correlation function rather than the Lagrangian correlation used in the previous studies. (10 refs.)

118572 On the organized motion of a turbulent plane jet. R.A.Antonia, L.W.B.Browne, S.Rajagopalan, A.J.Chambers (Dept. of Mech. Engng., Univ. of Newcastle, Newcastle, NSW, Australia).
J. Fluid Mech. (GB), vol.134, p.49-66 (Sept. 1983).
Measurements of space-time correlations of longitudinal and normal velocity fluctuations and of temperature fluctuations support the existence of counter-rotating spanwise structures appearing alternately on opposite sides of the jet centreline in the self-preserving region of the flow. The frequency of these structures closely satisfies self-preservation. The asymmetric arrangement of the structures is first observed downstream of the position where the jet mixing layers nominally merge but upstream of the onset of self-preservation. Closer to the jet exit, the space-time correlations indicate the existence of spanwise structures that are symmetrical about the centreline. (35 refs.)

118573 The destruction of temperature fluctuations in a turbulent plane jet. R.A.Antonia, L.W.B.Browne (Dept. of Mech. Engng., Univ. of Newcastle, Newcastle, NSW, Australia).
J. Fluid Mech. (GB), vol.134, p.67-83 (Sept. 1983).
The transport equation for the destruction of temperature fluctuations in a turbulent shear flow is briefly discussed from the point of view of the experimenter's ability to measure the important terms. The transport equation for only one component of the destruction, the mean-square streamwise temperature derivative, is considered in detail in the case of a steady two-dimensional turbulent shear flow. Measurements of most of the terms in this equation have been made in the self-preserving region of a turbulent plane jet. They indicate that the advection and diffusion terms are negligible compared with the production and dissipation terms. The measured terms are discussed in the context of local isotropy. Mean-square values of second-order derivatives satisfy local isotropy more closely than those of first-order derivatives. (27 refs.)

118574 The final stage of decay of turbulence in stably stratified fluid. H.J.Pearson, P.F.Linden (Dept. of Appl. Maths. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
J. Fluid Mech. (GB), vol.134, p.195-203 (Sept. 1983).
The linearized equations for the final stage of decay of turbulence in a stably stratified fluid are solved by three-dimensional Fourier transformation. For large Prandtl number, slowly decaying almost-horizontal modes of motion are identified. It is argued that these modes explain the experimental observation that patches of turbulence eventually settle out into a set of approximately horizontal striations. The most persistent vertical wavelength for a given

geometry is determined and compared with quantitative observations from a set of experiments. (14 refs.)

118575 Identification of the dynamic characteristics of a simple system with quadratic damping [turbulence]. M.Rades (Polytech. Inst., Bucharest, Rumania).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.4, p.439-46 (July-Aug. 1983).
Two methods are presented for the estimation of the dynamic parameters of a single degree of freedom system with directly coupled quadratic damping. The required experimental data are a set of polar diagrams of the harmonic response plotted for different (constant magnitude) force excitation level. (9 refs.)

118576 Maldistributed inlet flow effects on turbulent heat transfer and pressure drop in a flat rectangular duct. E.M.Sparrow, N.Cur (Dept. of Mech. Engng., Univ. of Minnesota, Minneapolis, MN, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.527-35 (Aug. 1983).
The effects of flow maldistribution caused by partial blockage of the inlet of a flat rectangular duct were studied experimentally. Local heat transfer coefficients were measured on the principal walls of the duct for two blockages and for Reynolds numbers spanning the range between 6000 and 30000. Measurements were also made of the pressure distribution along the duct, and the fluid flow pattern was visualized by the oil-lampblack technique. Large spanwise nonuniformities of the local heat transfer coefficient were induced by the maldistributed flow. These nonuniformities persisted to far downstream locations, especially in the presence of severe inlet flow maldistributions. Spanwise-average heat transfer coefficients, evaluated from the local data, were found to be enhanced in the downstream portion of the duct due to the flow maldistribution. However, at more upstream locations, where the entering flow reattached to the duct wall following its separation at the sharp-edged inlet, the average coefficients were reduced by the presence of the maldistribution. (8 refs.)

118577 Numerical prediction of wall temperatures for near-critical para-hydrogen in turbulent upflow inside vertical tubes. C.P.Bellmore, R.L.Reid (Dept. of Mech. & Aerospace Engng., Univ. of Tennessee, Knoxville, TN, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.536-41 (Aug. 1983).
Presented herein is a method of including density fluctuations in the equations of turbulent transport. Results of a numerical analysis indicate that the method may be used to predict heat transfer for the case of near-critical para-hydrogen in turbulent upflow inside vertical tubes. Wall temperatures, heat transfer coefficients, and velocities obtained by coupling the equations of turbulent momentum and heat transfer with a perturbed equation of state show good agreement with experiments for inlet reduced pressures of 1.28-5.83. (18 refs.)

118578 Heat transfer mechanisms and performance in multiple parallel disk assemblies. S.Mochizuki, Wen-Jei Yang (Dept. of Mech. Engng. & Appl. Mech., Univ. of Michigan, Ann Arbor, MI, USA), Y.Yagi, M.Ueno.
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.598-604 (Aug. 1983).
Heat transfer and frictional loss performance in radial flow through multiple parallel disk assemblies are experimentally studied by a modified single-blow transient test method. The mechanisms of heat transfer enhancement are determined in the four flow regimes which are characterized by different combinations of flow patterns: pure laminar, laminar-oscillating-laminar, laminar-oscillating-turbulent-laminar, and laminar-oscillating-turbulent type convection. The fifth convective regime is predicted. The results of a condensation-heated disk core are incorporated for discussion and performance comparison. The effects of the disk spacing and size and influx disturbance on the transfer performance are investigated. It is concluded that the disk device has the performance characteristics comparable to high-performance plate-fin type surfaces that are commonly employed in compact heat exchangers. (8 refs.)

The final approach to steady state in an axisymmetric stagnation flow following a change in free stream velocity .... See Entry 118553

Spinning modes on axisymmetric jets. I .... See Entry 118561

Onset of convection in a horizontal layer of cold water .... See Entry 118593

Gravity currents moving along a lateral boundary in a rotating fluid .... See Entry 118613

Turbulent exchange in the vortex model .... See Entry 118618

The 'whistler-nozzle' phenomenon .... See Entry 118652

Measurements of turbulent Prandtl number in a plane jet .... See Entry 118655

47.25F Boundary layer and shear turbulence

118579 On the structure and resolution of wall-pressure fluctuations associated with turbulent boundary-layer flow. G.Schewe (Max-Planck-Inst. fur Stromungsforschung, Gottingen, Germany).
J. Fluid Mech. (GB), vol.134, p.311-28 (Sept. 1983).
In a wind tunnel designed for flow-acoustic measurements, the wall-pressure fluctuations beneath a turbulent boundary layer have been investigated. The measurements were carried out with variously sized pressure transducers ($19 \leq d^+ \leq 333$) and with an array of four small transducers (separation distance $\Delta x^+ = 75$). It is shown that the dimensionless diameter $d^+ = 19$ of the transducers is sufficient to resolve the essential structures of the turbulent pressure fluctuations. The power spectrum $\Phi(\omega^+)$ measured with the smallest transducer $D^+ = 19$ partly exhibits power-law decay $\Phi \sim \omega^{-7/3}$, which has been theoretically predicted for locally isotropic turbulence. By visual analysis and signal averaging in the time domain, pressure structures with high amplitudes could be detected which have the shape of short wavetrains or pulses. Their characteristic frequency and longitudinal wavelength have the mean values $\omega^+ = 0.52$ and $\lambda^+ = 145$ respectively, and their mean convection velocity amounts to $u_c/u_\infty = 0.53$. It was calculated from the measured probability density that these characteristic structures play an important role, although the probability of their occurrence is low. The sources of these wall-pressure structures can be located in the buffer layer of the boundary layer. (23 refs.)

118580 On the gradient flow in a turbulent boundary layer. V.F.Potemkin.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.56-61 (1983). In Russian.
Using the turbulent boundary layer model, universal relations have been derived for turbulent transfer in a gradient flow. It is shown that the relations obtained allow the simplified calculation of turbulent transfer characteristics for gradient flow. The correlation of theoretical dependences with the known experimental data is quite satisfactory. (7 refs.)

Variable fluid property effects on transport in pure water around the density extremum .... See Entry 118601

Supersonic turbulent boundary layers subjected to a pressure gradient: calculation with a k-ε model .... See Entry 118635

Three dimensional model of turbulent exchange using pulsation energy balance equation .... See Entry 118682

47.25J Turbulent diffusion

118581 Heat-mass Onsager coefficients in ternary nonelectrolyte liquid mixtures. G.E.Platt, T.Vongvanich, R.L.Rowley (Dept. of Chem. Engng., W.M. Rice Univ., Houston, TX, USA).
J. Non-Equilibrium Thermodyn. (Germany), vol.8, no.1, p.1-18 (1983).
Diffusion thermoeffect experiments have been performed on ternary mixtures of toluene-chlorobenzene-bromobenzene at 298.15K and 308.15K. The temperature profiles obtained in response to isothermal chemical potential gradients have been evaluated in terms of two independent binary heats of transport. Onsager heat-mass coefficients have been computed from the resultant data. Although the heats of transport showed a complex composition dependence, the Onsager coefficients were generally much more planar, exhibiting a strong dependence upon the amount of bromobenzene, the most dense component. Thermal diffusion ratios computed from the Onsager coefficients (by Onsager reciprocity) indicate that the direction of separation of chlorobenzene in pure thermal diffusion separations would change with increasing bromobenzene composition. The Onsager coefficients measured in this study are believed to be the first ternary heat-mass cross coefficients experimentally obtained. They are consistent with the requirements placed upon them by the second law of thermodynamics. (21 refs.)

Influence of two-dimensional turbulence on diffusion .... See Entry 118569

47.25M Noise (turbulence generated)

An aeroacoustic model for high-speed, unsteady blade-vortex interaction .... See Entry 118322

Acoustic impulse generation by electric discharges .... See Entry 118776

47.25Q Convection and heat transfer

(see also 44.25 Convective and constrained heat transfer)

118582 Unsteady conjugated heat transfer near a stagnation point. D.G.Drake (Dept. of Maths., Southampton Univ., Southampton, England).
Appl. Sci. Res. (Netherlands), vol.40, no.3, p.199-207 (1983).
An analysis is presented for the unsteady thermal processes involved when a plane wall of high thermal conductivity loses heat to a fluid in two-dimensional stagnation point flow against the wall. It is assumed that the rear surface of the wall is insulated and the initial temperature of the wall is greater than that of the fluid. A complete description of the temperature history of the wall is obtained by developing solutions valid for small and large values of the time. (5 refs.)

118583 Study of nonlinear convection in a sparsely packed porous medium using spectral analysis. N.Rudraiah, Balachandra Rao (Dept. of Maths., Bangalore Univ., Bangalore, India).
Appl. Sci. Res. (Netherlands), vol.40, no.3, p.223-45 (1983).
Nonlinear study cellular convection in a sparsely packed fluid saturated porous medium is investigated, considering the Brinkman model using the technique of spectral analysis. It is established how the Brinkman model with free-free boundaries generalizes the study of convection in a porous medium in the sense that it yields the results tending to those of viscous and Darcy flows respectively for very small and very large values of the permeability parameter σ^2. It also provides results for the transition zone (i.e. $10^2 < \sigma < \sigma^2 < 10^3$). The cross-interaction of the linear modes caused by nonlinear effects are considered through the modal Rayleigh number R_γ. The possibility of the existence of steady solution with two self-excited modes in certain regions is predicted. The similarities of present analysis with and advantages over that of the power integral technique are brought out. A detailed discussion of the heat transport, with the effect of permeability thereon, is made. The theoretical values of the Nusselt number are found to be in good agreement with experimental results. (24 refs.)

118584 Numerical solution of natural convection in eccentric annuli. D.W.Pepper, R.E.Cooper (E.I. du Pont de Nemours & Co., Aiken, SC, USA).
AIAA J. (USA), vol.21, no.9, p.1331-7 (Sept. 1983).
The governing equations for transient natural convection in eccentric annular space are solved with two high-order accurate numerical algorithms. The equation set is transformed into bipolar coordinates and split into two one-dimensional equations: finite elements are used in the direction normal to the cylinder surfaces: the pseudospectral technique is used in the azimuthal direction. Transient solutions of the entire flowfield are obtained for $10^2 \leq Ra \leq 10^6$, $0.70 \leq Pr \leq 10^2$, with the inner cylinder near the top, bottom, and side of the outer cylinder. Results are similar to experimental and numerical values previously published for low *Ra* numbers. (26 refs.)

118585 Fluid flow and heat transfer in corrugated wall channels. III. Effects of bending angles in the case where channels are bent two times. R.Izumi, H.Yamashita (Faculty of Engng., Nagoya Univ., Nagoya, Japan), K.Oyakawa, N.Mori.
Bull. JSME (Japan), vol.26, no.216, p.1027-35 (June 1983).
For pt.II see ibid., vol.24, no.198, p.2098 (1981). Corrugated wall channels are investigated as a means of augmenting forced-convection heat transfer with a single-phase flow in heat exchangers. Fluid flow states and heat transfer characteristics of parallel channels bent two times which are fundamental elements of corrugated wall channels are examined by numerical analyses and experiments for the pitch $P=3$ and the bending angle $\theta = 0° \sim 90°$. Consequently, effects of bending angles on aspects of flow, wall shear stress and local Nusselt number distributions, pressure losses and mean Nusselt numbers are clarified, and adequate values of bending angles are examined. (10 refs.)

118586 Free convection around tubes mounted parallel and horizontal to air flow. Analysis of the local coefficient dependence on spacing and temperature. R.Diez Gonzalez (Facultad de Fisicas, Univ. de Valencia, Valencia, Spain), M.Buendia Gomez, M.Dolz Planas.
An. Fis. Ser. B (Spain), vol.79, no.2, p.146-51 (May-Aug. 1983). In Spanish. [received: Oct. 1983]
Using double exposure holography the temperature field around two aluminium cylinders (10.5 cm length and 1 cm diameter) placed horizontal and parallel to the airstream has been investigated. On the basis of the experimental data the local, and average, convection coefficient and Nusselt number

and variation with the temperature and distance have been calculated. (6 refs.)

118587 Convection driven by concentration- and temperature-dependent surface tension. C.L.McTaggart (Dept. of Maths., Univ. of Glasgow, Glasgow, Scotland).
J. Fluid Mech. (GB), vol.134, p.301-10 (Sept. 1983).
Generalizes the linear stability analysis of Pearson for Marangoni instability to the case where surface tension depends on both temperature and solute concentration. The results are expressed in terms of a thermal Marangoni number B_T and a solutal Marangoni number B_S. It is found when $B_S>0$ the onset of instability has the form of stationary convection, while when $B_S<0$ there are circumstances in which the onset of instability is in the form of oscillatory convection. (14 refs.)

118588 Laminar natural convection in an inclined rectangular box with the lower surface half-heated and half-insulated. P.K.-B.Chao (Dept. of Chem. Engng., Univ. of Pennsylvania, Philadelphia, PA, USA), H.Ozoe, S.W.Churchill, N.Lior.
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.425-32 (Aug. 1983).
The pattern of circulation and the rate of heat transfer were determined experimentally and also by three-dimensional, finite-difference calculations for an inclined $2\times1\times1$ rectangular enclosure with a 1×1 segment of the lower 2×1 surface at a uniform temperature, the other 1×1 segment and four side walls insulated, and the upper surface at a lower uniform temperature. As contrasted with an enclosure heated and cooled on the horizontal surfaces, a fluid motion occurs and the rate of heat transfer exceeds that for pure conduction for all temperature differences and orientations. The effects of elevation of the heated and insulated segments were investigated, as well as of inclination about the longer dimension. Despite differences in the Prandtl and Rayleigh numbers, the observed and predicted patterns of circulation are in good agreement, and the measured and predicted rates of heat are in qualitative agreement. (17 refs.)

118589 An experimental study of free convective heat transfer in a parallelogrammic enclosure. N.Seki, S.Fukusako, A.Yamaguchi (Dept. of Mech. Engng., Hokkaido Univ., Sapporo, Japan).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.433-9 (Aug. 1983).
Experimental measurements are presented for free convective heat transfer across a parallelogrammic enclosure with the various tilt angles of parallel upper and lower walls insulated. The experiments covered a range of Rayleigh numbers between 3.4×10^4 and 8.6×10^7, and Prandtl numbers between 0.70 and 480. The fluids used were air, transformer oil and water. It was found that the heat transfer coefficients for tilt angle $\phi=-70$ deg were decreased to be about 1/18 times those for $\phi=0$ deg. Experimental results are given as plots of the Nusselt number versus the Rayleigh number. A correlation equation is given for the Nusselt number, Nu, as a function of ϕ, Pr, and Ra. (22 refs.)

118590 Natural convection heat transfer between bodies and their spherical enclosure. R.E.Powe (Mississippi State Univ., Mississippi State, MS, USA), R.O.Warrington,Jr..
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.440-6 (Aug. 1983).
The natural convective heat transfer phenomena which occur between a body and its spherical enclosure have been experimentally investigated. Bodies of several different shapes were employed, so the results should have broad applicability. New temperature field and heat transfer results, in the form of natural convection from cubical inner bodies to a spherical enclosure, have been combined with previously available enclosure data. By considering all of the data combined, trends in the behavior of the convective heat transfer phenomena have been established, thus enabling a much more reliable analysis of enclosed body problems than is now possible. A very general heat transfer correlation has been developed which predicts the natural convection heat transfer from spheres (concentric and eccentric), cylinders, and cubes to a spherical enclosure with an average deviation of less than 12 percent. (20 refs.)

118591 Heat transfer from a heated pool to a melting miscible substrate. I.Catton, W.A.Brinsfield, S.M.Ghiaasiaan (School of Engng. & Appl. Sci., Univ. of California, Los Angeles, CA, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.447-53 (Aug. 1983).
Melting a miscible substrate by a heated overlying pool of higher density is studied experimentally. The heated pool is either carbon tetrachloride or diiodomethane, and the substrate is frozen benzene. By performing the experiments with heated pools of different densities the effects of pool-to-substrate temperature differences and pool-density to melt-density ratios on melting heat transfer are independently studied. Heat transfer rates are reported as a function of both temperature difference and density ratio. A model is postulated and compared with experimental results. The downward heat flux is found to be essentially independent of temperature differences, while being an increasing function of the density ratio between the pool and the melting solid for large density ratios. For low-density ratios a buoyant plume analysis was used to obtain a correlation. (18 refs.)

118592 Free convection in a vertical annulus with constant heat flux on the inner wall. M.Keyhani, F.A.Kulacki, R.N.Christensen (Dept. of Mech. Engng., Ohio State Univ., Columbus, OH, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.454-9 (Aug. 1983).
Heat transfer measurements are presented for free convection in a vertical annulus wherein the inner cylinder is at constant surface heat flux and the outer cylinder is at constant temperature. Overall heat transfer data are corrected for thermal radiation in the annulus. Rayleigh numbers span the conduction, transition and boundary layer regimes of flow, and average heat transfer coefficients are obtained with air and helium as the working fluids. The range of Rayleigh number is $10^3<\mathrm{Ra}<2.3\times10^6$; the radius ratio is 4.33; and the aspect ratio (cylinder length divided by annular gap) is 27.6. Energy transferred by thermal radiation varies with Rayleigh number and working fluid. With air, thermal radiation can account for up to 50 percent of the heat transfer. With helium, radiation can account for up to 30 percent of the heat transfer rate. (10 refs.)

118593 Onset of convection in a horizontal layer of cold water. J.C.Mollendorf (State Univ. of New York, Amherst, NY, USA), K.H.Jahn.
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.460-4 (Aug. 1983).
Parabolic, cubic, and higher order expressions have been used in previous investigations to relate temperature to density in the vicinity of the density extremum. Another equation of state, based on the careful measurement of the density variations of both pure and saline water, has been used to determine the onset of convection in a horizontally confined layer of water near its density extremum. The simplicity of this equation gives rise to a minimum number of problem particular parameters, and relatively easily allows for the inclusion of both pressure and salinity level effects (neglecting saline diffusion). The boundaries are considered to be rigid-rigid and of infinite thermal capacity. Present numerical results are compared with those previously calculated using other density relationships, including that embodied in the linear Oberbeck-Boussinesq approximation. Density extremum effects are seen to be stabilizing, with critical Rayleigh numbers calculated to be about 10 percent below those obtained using a parabolic density-temperature relationship and quite close to those found using a fifth-order polynomial. There is an associated increase in calculated wave number with the inclusion of density extremum effects. (21 refs.)

118594 Natural convection along a vertical wavy surface. L.S.Yao (Dept. of Mech. & Aerospace Engng., Arizona State Univ., Tempe, AZ, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.465-8 (Aug. 1983).
A transformation method is applied to study the natural convection along irregular vertical surfaces. A sinusoidal surface is used as a specific example to demonstrate the advantages of the transformation method, and to elucidate the heat transfer mechanism near such surfaces. The numerical results show that the frequency of the local heat transfer rate is twice that of the wavy surface. The amplitude of the oscillating local Nusselt number gradually decreases downstream where the natural convection boundary layer grows thick. (3 refs.)

118595 Numerical study of transient high Rayleigh number convection in an attic-shaped porous layer. D.Poulikakos (Dept. of Mech. Engng., Univ. of Illinois, Chicago, IL, USA), A.Bejan.
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.476-84 (Aug. 1983).
Scaling arguments and numerical analysis are used to document the transient and steady-state regimes of natural convection in a triangular porous layer cooled from above (along the sloping wall). The numerical simulations are conducted in the high Rayleigh number domain, Ra=100, 1000, where Ra is the Darcy-modified Rayleigh number based on height, H. The scale analysis predicts the existence of distinct thermal boundary layers if $\mathrm{Ra}^{1/2}$ $(H/L)>1$, where H/L is the height/length geometric ratio of the attic-shaped porous layer. The numerical simulations confirm the scaling results as well as the prediction that the flow consists primarily of an elongated horizontal counterflow driven by the cold wall. In addition, the numerical solutions show the presence of a Benard-type instability at high enough Rayleigh numbers. For example, if $H/L=0.2$, the instability is present when $\mathrm{Ra}>620$; this critical Rayleigh number is found to increase as H/L increases. (12 refs.)

118596 Heat transfer in porous media heated from above with evaporation, condensation, and capillary effects. K.S.Udell (Dept. of Mech. Engng., Univ. of California, Berkeley, CA, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.485-92 (Aug. 1983).
Heat and mass transfer characteristics of a sand-water-steam system heated at the top and cooled at the bottom were studied. It was found that at steady-state conditions the system segregated into three regions. The top region was conduction-dominated with the voids containing a stationary superheated steam. The middle region was convection-dominated, nearly isothermal, and exhibited an upward flow of the liquid by capillary forces and a downward flow of steam due to a slight pressure gradient. The bottom portion contained a stationary compressed liquid and was also conduction dominated. The length of the two-phase convection zone was evaluated through the application of Darcy's equations for two-phase flow and correlations of relative permeabilities and capillary pressure data. The model was in excellent agreement with the observed results, predicting a decreasing two-phase zone length with increasing heat flux. The thermodynamics of the two-phase zone were also analyzed. (17 refs.)

118597 Combined free and forced convection of water between horizontal concentric cylinders. T.Hung Nguyen, P.Vasseur, L.Robillard, B.Chandra Shekar (Dept. of Civil Engng., Univ. de Montreal, Montreal, Quebec, Canada).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.498-504 (Aug. 1983).
Presents a theoretical study of combined free and forced laminar convection of a mass of water confined between two horizontal concentric cylinders with constant surface temperatures and subject to an externally-imposed constant pressure gradient along the axial direction. The governing system of differential equations is solved, within the Boussinesq approximation, by perturbation and finite difference methods, and the solutions are obtained in terms of the various characteristic parameters of the problem. Essentially, it is found that the flow pattern and the wall shear stress in the axial direction are significantly affected by the Prandtl and the Rayleigh numbers. Thus, the axial flow shows a tendency to develop in two or even three jets, depending on the Rayleigh number. The occurrence of the inversion of density, for water at 4°C, was found to modify completely the convective, or secondary flow, but to have little effect on the main, or axial, flow. (24 refs.)

118598 Heat transfer of power law fluid at low Peclet number flow. Vi-Duong Dang (Dept. of Chem. Engng. & Materials Sci., Catholic Univ. of America, Washington, DC, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.542-9 (Aug. 1983).
An exact solution is presented for the temperature distribution and local Nusselt number of power law fluid in conduit at low Peclet number flow by considering axial conduction in both the upstream and the downstream regions while keeping the wall at constant temperature. Solutions are also reported for the parallel plate geometry for the aforementioned heat transfer condition and for constant wall heat flux boundary condition. The order of importance of axial conduction is established for different geometries and different boundary conditions. The effect of axial conduction is more significant when power law model index, s, increases for constant wall heat flux case, but the effect changes with Peclet number for constant wall temperature case. (25 refs.)

118599 Finite analytic numerical solution axisymmetric Navier-Stokes and energy equations. Ching-Jen Chen, Young Hwan Yoon (Div. of Energy Engng., Univ. of Iowa, Iowa City, IA, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.639-45 (Aug. 1983).
Convective heat transfer for steady-state laminar flow in axisymmetric coordinates is considered. Numerical solutions for flow pattern and temperature distribution are obtained by the finite analytic numerical method applied to the Navier-Stokes equations expressed in terms of vorticity and stream function, and the energy equation. The finite analytic numerical method differs from other numerical methods in that it utilizes a local analytic solution in an element of the problem to construct the total numerical solution. Finite analytic solutions of vorticity, stream function, temperature, and heat transfer coefficients for flow with Reynolds numbers of 5, 100, 1000, and 2000, and Prandtl numbers of 0.1, 1.0, and 10.0 with uniform grid sizes, are reported for an axisymmetric pipe with a sudden expansion and contraction. The wall temperature is considered to be isothermal and differs from the inlet temperature. It is shown that the finite analytic is stable, converges rapidly, and simulates the convection of fluid flow accurately, since the local analytic solution is capable of simulating automatically the influence of skewed convection through the element boundary on the interior nodal values, thereby minimizing the false numerical diffusion. (11 refs.)

118600 Natural convection experiments in a triangular enclosure. D.Poulikakos (Dept. of Mech. Engng., Univ. of Illinois, Chicago, IL, USA), A.Bejan.
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.652-5 (Aug. 1983).
Reports the results of a study of steady natural convection heat transfer in an attic-shaped (triangular) space. The experiment described was designed to shed light on the unknown phenomenon which might occur in a large-scale system, for example, in a life-size attic space or in ocean waters near shores with sloping bottoms. For this reason, the experimental study focused on: (i) a high Rayleigh number range not studied before, 10^6-10^9; (ii) the flow regime and, especially, those flow features which may prove essential in the future effort of modeling the phenomenon analytically. These objectives were achieved using a relatively large apparatus filled with air or water. The experiment simulated the 'night' mode of operation of an attic space, or the 'day' mode of a shallow-sloped coastal body of water heated from below by solar radiation. This simulation consisted of cooling the upper wall and heating the bottom wall of the experimental enclosure. (11 refs.)

118601 Variable fluid property effects on transport in pure water around the density extremum. R.D.Padlog (Turbocompressor Div., Joy Machinery Co., Buffalo, NY, USA), J.C.Mollendorf.
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.655-8 (Aug. 1983).
Numerous previous studies of buoyancy induced flows in cold water have been described by Gebhart and Mollendorf (1978). Ice melting experiments were done in pure water by Bendell and Gebhart (1976) followed by measurements in pure and saline water by Johnson and Mollendorf. At small temperature differences, the error between experiment and the constant property theory of Gebhart and Mollendorf (1978) is very small. However, as the temperature difference increases, the data are seen to be about 15 percent lower than constant property theory at about 20°C. In an attempt to explain the difference between constant property calculations and previous experiments, the authors' study extends the variable property calculations of Shaukatullah and Gebhart (1978) to include the region of convective inversion. Convective boundary layer flow is considered adjacent to an isothermal flat plate, which is in water at atmospheric pressure. Complications due to ice melting are considered, in as much as the effect of melted water produced is included in the boundary conditions as blowing and is shown to have an important effect on heat transfer. (6 refs.)

118602 A heat transfer correlation for natural convection from a vertical surface in cold water. V.P.Carey (Dept. of Mech. Engng., Univ. of California, Berkeley, CA, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.658-60 (Aug. 1983).
A new correlation is presented for natural convection heat transfer from a vertical isothermal surface in cold water. The correlation contains only one additional dimensionless parameter beyond the Nusselt, Grashof, and Prandtl numbers. This additional parameter quantifies the nonlinear density effect on transport. A major advantage of this correlation over Merk's (1953) is that its simple form makes it easier to observe and interpret trends in the heat transfer as conditions change. This simplicity is achieved without significant loss in accuracy. (12 refs.)

118603 Transient and steady-state natural convection in a porous medium between two concentric cylinders. G.N.Facas, B.Farouk (Dept. of Mech. Engng. & Mech., Drexel Univ., Philadelphia, PA, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.660-3 (Aug. 1983).
In the authors' work, transient, two-dimensional numerical calculations are presented for natural convective flow in a porous concentric annulus heated from inside. Several areas in which the natural convective transport of heat in such a geometry is important include buried pipelines, storage of solar energy in underground containers, and recovery of geothermal energy. Transient and steady-state solutions are obtained over a large range of Rayleigh number (10^0-10^3) using a finite difference method with central difference expressions. (8 refs.)

Heat and mass transfer in a disperse nonequilibrium chemically reacting two-phase flow in a vertical channel ....See Entry 117635

Evaporation of water from a horizontal surface by natural convection ....See Entry 118366

Surface microfouling during the induction period ....See Entry 118373

An interferometric investigation of separated forced convection in laminar flow past cavities ....See Entry 118552

Maldistributed inlet flow effects on turbulent heat transfer and pressure drop in a flat rectangular duct ....See Entry 118576

Numerical prediction of wall temperatures for near-critical para-hydrogen in turbulent upflow inside vertical tubes ....See Entry 118577

Heat transfer mechanisms and performance in multiple parallel disk assemblies ....See Entry 118578

Heat-mass Onsager coefficients in ternary nonelectrolyte liquid mixtures ....See Entry 118581

Rotating convective fluid flows with hall current effects ....See Entry 118609

Heat transfer to a fluid in radial, outward flow between two coaxial stationary or corotating disks ....See Entry 118615

Heat transfer in the flow of a second-order fluid under an enclosed rotating disc ....See Entry 118645

Analysis of coolant entrance boundary shape of porous region to control cooling along exit boundary ....See Entry 118671

Experiments on a crossflow heat exchanger with tubes of lenticular shape ....See Entry 118677

Three dimensional model of turbulent exchange using pulsation energy balance equation ....See Entry 118682

Stability of convection rolls in the presence of a horizontal magnetic field ....See Entry 118686

H-theorem and Onsager principle in the stationary Boltzmann equation ....See Entry 118702

Effect of radial diffusion on the polarization at porous flow-through electrodes ....See Entry 120638

Investigation of kinetics of microconvection of a water surface film ....See Entry 121287

47.25R Wakes

118604 Separated flow flutter of two dimensional triangular cylinder subjected to uniform flow from base. I. Preliminary experimental studies with flow visualizations by water tank and wake survey with small wind tunnel. T.Nagashima, K.Moriya, N.Iboshi, T.Shimomura (Dept. of Aeronautical Engng., Nat. Defense Acad., Yokosuka, Japan).
Sci. & Eng. Rep. Natl. Def. Acad. (Jpn.) (Japan), vol.20, no.4, p.415-34 (Dec. 1982). In Japanese. [received: Sept. 1983]
Discusses the dynamical angular motion of an isosceles triangular cylinder subjected to an uniform flow from its base surface in relation to wake structure. Results of flow visualization tests by the water tank and wake survey tests by the wind tunnel with two dimensional modes in fixed and rotation free conditions are presented. It is understood that the steady angular motion of the triangular cylinder subjected to uniform flow from the base is not the forced vibration due to Karman Vortex, but the typical self-excited oscillation caused by quasi-steady aerodynamical characteristics of its cross-section. It is also anticipated that the reattachment of the separated flow may play an important role to stabilize its self-excited oscillation. (7 refs.)

The two-dimensional laminar wake with initial asymmetry ....See Entry 118551

A finite-volume, adaptive grid algorithm applied to planetary entry flowfields ....See Entry 121583

47.30 ROTATIONAL FLOW AND VORTICITY

118605 Spin-up from rest in a differentially rotating cylinder. J.M.Hyun (Clarkson Coll. of Technol., Potsdam, NY, USA).
AIAA J. (USA), vol.21, no.9, p.1278-82 (Sept. 1983).
Spin-up from rest in a cylinder with top and bottom end-wall disks rotating at different rates (Ω_T and Ω_B, respectively) is investigated by numerically integrating the unsteady Navier-Stokes equations. The approximate analytical model due to Wedemeyer and Venezian is briefly recounted. Numerical solutions for three sets of Ω_T/Ω_B for a cylinder of aspect ratio $O(1)$ and a minute Ekman number are presented. The results are detailed flowfield data that display the transient azimuthal velocity profiles, axial vorticity distributions, and the meridional flow patterns. An azimuthal velocity shear front, which separates the rotating from the nonrotating fluid, propagates radially inward. As Ω_T/Ω_B becomes close to unity, the propagation speed of the front increases and the spin-up in the interior is more effective. The axial vorticity is zero ahead of the front and is larger than twice the final-state angular speed of the fluid behind the front. The meridional circulation is no longer antisymmetric about the cylinder mid-depth as Ω_T/Ω_B deviates from unity. (14 refs.)

118606 Flows and pressure recovery in a rotating diffuser. Effects of inlet velocity distributions. K.Kikuyama, M.Murakami (Dept. of Mech. Engng., Nagoya Univ., Nagoya, Japan), S.Oda.
Bull. JSME (Japan), vol.26, no.216, p.970-7 (June 1983).
The flow patterns and pressure recoveries in a rotating two dimensional diffuser were studied for the case where uneven flows with a shear type velocity distribution were introduced into it. If the entering flow has higher velocities near the lower pressure side of the diffuser, the pressure recovery is improved by rotation of the diffuser and the recovery coefficient becomes higher than that observed in the stationary state of the diffuser. The improvement will be caused by a uniformalization of flow velocities in the rotating duct due to a vigorous secondary flow development. The reverse results prevail in the case where the flow enters the diffuser with higher velocities near the pressure side of the diffuser, the secondary flow being less vigorous in this case. (11 refs.)

118607 The structure of turbulence in homogeneous and stratified rotating fluids. E.J.Hopfinger, R.W.Griffiths, M.Mory (Inst. de Mecanique de Grenoble, Grenoble, France).
J. Mec. Theor. & Appl. (France), spec, suppl., p.21-44 (1983).
The authors briefly review laboratory experiments with turbulence in a rapidly rotating fluid and present new measurements of the flow that is created by an oscillating grid in a rotating container. These measurements show the quasi-two-dimensional nature of the turbulence. Freely evolving turbulence that ensues after forcing is stepped is also investigated. The length scale of the flow is found to increase due to the coalescence of vortices of like sign and doubles in a time which is an order of magnitude larger than the eddy turnover time. This flow is compared with that observed in recent experiments with a field of turbulence that is produced by baroclinic instability of a two-layer density stratification. (27 refs.)

118608 The mixing layer: an example of quasi two-dimensional turbulence. F.K.Browand, C.-H.Ho (Dept. of Aerospace Engng., Univ. of Southern California, Los Angeles, CA, USA).
J. Mec. Theor. & Appl. (France), spec, suppl., p.99-120 (1983).
During the last decade, it has been gradually recognized that a coherent large scale structure is the essential feature of many turbulent shear flows. In the turbulent mixing layer, this structure takes the form of quasi two-dimensional vortices aligned across the span of the flow. At least 50 per cent of the fluctuating (turbulent) kinetic energy can be directly associated with these vortices. Vortex interactions are responsible for the cross stream momentum transfer. Furthermore, the growth and entrainment properties of the mixing layer—determined by vortex interactions—can be effectively manipulated with very small, spatially coherent perturbations. (22 refs.)

118609 Rotating convective fluid flows with hall current effects. D.R.V.Prasada Rao, D.V.Krishna (Dept. of Maths., SK Univ., Anantapur, India).
Indian J. Pure & Appl. Math., vol.14, no.9, p.1105-16 (Sept. 1983).
An initial value investigation is made of the Hall effects on free and forced convective flow in a rotating channel. The unsteady problem is exactly solved by a method similar to that of Debnath et al. (1979). The steady state and the transient solutions are obtained with physical discussions. The structures of the associated boundary layers discussed are for small, intermediate and large frequency oscillations. The solution is obtained analytically and the behaviour of the velocity and shear stresses is discussed numerically for different values of the governing parameters. (15 refs.)

118610 Flow between rotating disks. I. Basic flow. A.Z.Szeri, S.J.Schneider, F.Labbe (Dept. of Mech. Engng., Univ. of Pittsburgh, Pittsburgh, PA, USA), H.N.Kaufman.
J. Fluid Mech. (GB), vol.134, p.103-31 (Sept. 1983).
Laser-Doppler velocity measurements were obtained in water between finite rotating disks, with and without throughflow, in four cases: $\omega_1\omega_2=0$; $\omega_2/\omega_1=-1$; $\omega_2/\omega_1=0$; $\omega_2/\omega_1=1$. The equilibrium flows are unique, and at mid-radius they show a high degree of independence from boundary conditions in r. With one disk rotating and the other stationary, this mid-radius 'limiting flow' is recognized as the Batchelor profile of infinite-disk theory. Other profiles, predicted by this theory to coexist with the Batchelor profile, were neither observed experimentally nor were they calculated numerically by

the finite-disk solutions, obtained via a Galerkin, *B*-spline formulation. Agreement on velocity between numerical results and experimental data is good at large values of the ratio R_Q/R_e, where $R_Q=Q/2\pi\nu s$ is the throughflow Reynolds number and $R_e=R_2^2\omega/\nu$ is the rotational Reynolds number. (26 refs.)

118611 Flow between rotating disks. II. Stability. A.Z.Szeri, A.Giron, S.J.Schneider (Dept. of Mech. Engng., Univ. of Pittsburgh, Pittsburgh, PA, USA), H.N.Kaufman.
J. Fluid Mech. (GB), vol.134, p.133-54 (Sept. 1983).
For pt.I see ibid., vol.134, p.103 (1983). Infinite-disk flows appear to possess multiple solutions at $E^{-1}=275$ (Holodniok, Kubicek and Hlavacek 1977), where $E=\nu/s^2\omega$ is the Ekman number. One of these solutions exhibits characteristics of Couette flow and is stable in the circular domain $0<r/s<50$. The other two solutions, both Poiseuille-type flows, are unstable at all positions. The stable solution shows strong resemblance to experimental profiles obtained between finite disks. Stability of finite-disk flows is investigated in two cases: (i) one disk rotating and the other stationary, and (ii) counter-rotating disks. Photographs indicate presence of two instability types. Theoretical calculations are in fair agreement with experimental evidence on instability of type I. (29 refs.)

118612 The standing vortex behind a disk normal to uniform flow at small Reynolds number. T.Miyagi, T.Kamei (Coll. of Engng., Univ. of Osaka Prefecture, Sakai, Japan).
J. Fluid Mech. (GB), vol.134, p.221-30 (Sept. 1983).
Viscous incompressible flow around a circular disk set normal to undisturbed flow is studied theoretically at small values of the Reynolds number. The critical Reynolds number at which a standing vortex first appears behind the disk is zero, and the flow separates from the edge of the disk. Several other features of the flow are obtained from the present analysis. (5 refs.)

118613 Gravity currents moving along a lateral boundary in a rotating fluid. R.W.Griffiths, E.J.Hopfinger (Inst. de Mecanique de Grenoble, Grenoble, France).
J. Fluid Mech. (GB), vol.134, p.357-99 (Sept. 1983).
Density currents in a rotating fluid are produced by releasing a volume of buoyant fluid from a lock at one end of a long rotating channel. Coriolis forces hold the current against one wall. It is observed that the velocity and depth of the nose decrease exponentially in time, implying that the nose can effectively come to a halt at a finite distance from the lock. In reality though, the flow regime eventually changes and a viscous wedge-shaped intrusion continues. The high-Reynolds-number currents contain three-dimensional turbulence a short distance behind the nose, but the influence of rotation causes this to become quasi-two-dimensional further upstream. The intrusion and turbulent motions represent a forcing to the lower layer that produces vortex and wave-like motions which penetrate deep into the lower-layer fluid. It is shown that the exponential decay can be attributed to radiation of momentum by these inertial waves. (22 refs.)

118614 Initial stages in the development of thermals. B.I.Zaslavskii.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.792-5 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR)*, vol.23, no.6, p.65-9 (Nov.-Dec. 1982). [received: Sept. 1983]
A free spherical volume of fluid that is lighter than the surrounding medium is transformed into a vortex ring, i.e. the core of a buoyant vortex ring. In the present paper the transformation process is discussed, experimental results are given, and equations are developed to determine the fundamental parameters that arise as a result of such a process of the buoyant vortex-thermal ring. (10 refs.)

118615 Heat transfer to a fluid in radial, outward flow between two coaxial stationary or corotating disks. N.V.Suryanarayana, T.Scofield, R.E.Kleiss (Dept. of Mech. Engng. & Engng. Mech., Michigan Technol. Univ., Houghton, MI, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.519-26 (Aug. 1983).
An experimental study of heat transfer rates to air flowing radially outward between two coaxial, corotating disks was made. Heat transfer data were obtained for five mass flow rates with stationary disks and four mass flow rates and five rotational speeds with rotating disks. Rotation of the disks slightly decreased the average Nusselt numbers compared with the average Nusselt numbers without rotation at the highest speed of rotation (600 r.m.p.), but at lower speeds no consistent trends were observed. The average Nusselt numbers, with and without rotation, can be related as $\mathrm{Nu}=0.0529\ \mathrm{Re}^{0.71}$ and the local Nusselt number as $\mathrm{Nu}=0.124\ \mathrm{Re}^{0.608}$. (6 refs.)

118616 Boundary layers on characteristic surfaces for time-dependent rotating flows. R.F.Gans (Dept. of Mech. Engng., Univ. of Rochester, Rochester, NY, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.2, p.251-4 (June 1983).
Time-dependent motion of a fluid in a container rotating at Ω is characterized by boundary layers on the container surfaces if ν/Ω, where ν denotes kinematic viscosity, is small compared to the square of a typical length of the container. Let the frequency of the motion, measured in a corotating coordinate system, be $\omega\Omega$. If $\omega\sim1$, then the length scale of the boundary layer is $(\nu/\Omega)^{1/2}$, unless $|\omega|$ is equal to twice the normal component of the unit rotation vector. If $|\omega|$ does equal twice the normal component of the unit rotation vector, scales of $(\nu/\Omega L^2)^{1/3}L$ and $(\nu/\Omega L^2)^{1/4}L$ are possible. If the normal vector and rotation vectors are parallel, the former scale vanishes. (6 refs.)

118617 Superpotential solution for jet-engine external potential and internal rotational flow interaction. W.C.Chin.
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.2, p.259-64 (June 1983).
For flows with prescribed parallel shear far upstream, the vorticity generation term in the disturbance stream-function (ψ) equation and the Bernoulli 'constant,' both of which vary from stream surface to stream surface, are explicitly evaluated as power series in ψ with curvature-dependent coefficients, for axisymmetric flows using some invariant properties of vorticity. By casting the linearized stream-function equation in conservation form, extended Cauchy-Reimann conditions are obtained, implying a 'superpotential' ϕ^* satisfying a 'Laplace-like' equation useful for solving flows past prescribed shapes; the corresponding tangency and Kutta conditions, interestingly, take a 'potential form,' so that simple changes to existing potential flow algorithms extend their applicability to strong oncoming shears with arbitrary curvature. The theory, which applies to duct flows behind actuator disks generating shear, is sketched for both 'analysis' and 'design' formulations; the authors address the interaction between external potential and internal rotational jet-engine flows occurring through both an assumed actuator disk and a trailing edge slipstream, and provide representative numerical calculations. (4 refs.)

118618 Turbulent exchange in the vortex model. I.Z.Gabdullin, A.A.Solov'ev, A.D.Solodukhin.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.54-6 (1983). In Russian.
Experimental results on turbulent stresses and averaged velocities in eddy vertical air flows are reported. (7 refs.)

An aeroacoustic model for high-speed, unsteady blade-vortex interaction ....See Entry 118322

Noise generation by a low-Mach-number jet ....See Entry 118323

The well-posedness of two-dimensional ideal flow ....See Entry 118547

A discrete vortex simulation of Kelvin-Helmholtz instability . See Entry 118555

Spinning modes on axisymmetric jets. I ....See Entry 118561

Introduction to two-dimensional turbulence ....See Entry 118562

The prevalence of two-dimensional motion in the turbulent mixing layer ....See Entry 118563

On the organized motion of a turbulent plane jet ....See Entry 118572

Finite analytic numerical solution axisymmetric Navier-Stokes and energy equations ....See Entry 118599

Theory of interaction of gravity waves with hydrodynamic turbulence ....See Entry 118624

Nonlinear stability conditions and a priori estimates for barotropic hydrodynamics ....See Entry 118628

Heat transfer in the flow of a second-order fluid under an enclosed rotating disc ....See Entry 118645

Perturbation theory for viscoelastic fluids between eccentric rotating cylinders ....See Entry 118647

Plane jet interaction with three-dimensional disturbances ...... See Entry 118653

Fluid motion and mixing in a gas-liquid contactor with turbine agitators ....See Entry 118659

Longitudinal vortices in wind tunnel wall boundary layers ..... See Entry 118672

The dynamics of two-dimensional ideal MHD ....See Entry 118685

Flow characteristics in the curved rectangular channels. Visualization of secondary flow ....See Entry 118689

The use of coloured smoke to visualize secondary flows in a turbine-blade cascade ....See Entry 118691

47.35 WAVES

118619 The stability of steep gravity waves. M.Tanaka (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3047-55 (Sept. 1983).
The linear stability of steep gravity waves is investigated for superharmonic disturbances. For this problem, Longuet-Higgins presented a conjecture that the gravity wave would become unstable to superharmonic disturbances at the steepness where the phase speed of the wave attains a maximum. Contrary to this conjecture, it is found that the instability first occurs at the steepness which corresponds to the maximum not of the phase speed but of the total energy and the impulse of the wave. This discrepancy implies the possibility of the superharmonic bifurcation of steady gravity waves in the region of large steepness. (9 refs.)

118620 Solitary and periodic gravity-capillary waves of finite amplitude. J.K.Hunter (Dept. of Maths., Colorado State Univ., Fort Collins, CO, USA), J.-M.Vanden-Broeck.
J. Fluid Mech. (GB), vol.134, p.205-19 (Sept. 1983).
Two-dimensional solitary and periodic waves in water of finite depth are considered. The waves propagate under the combined influence of gravity and surface tension. The flow, the surface profile and the phase velocity are functions of the amplitude of the wave and the parameters $l=\lambda/H$ and $\tau=T/\rho gH^2$. Here λ is the wavelength, H the depth, T the surface tension, ρ the density and g the acceleration due to gravity. For $\tau>{}^1/_3$, large values of l and small values of the amplitude, the profile of the wave satisfies the Korteweg-de Vries equation approximately. However, for τ close to ${}^1/_3$ this equation becomes invalid. In the authors' paper a new equation valid for τ close to ${}^1/_3$ is obtained. Moreover, a numerical scheme based on an integro-differential-equation formulation is derived to solve the problem in the fully nonlinear case. Accurate solutions for periodic and solitary waves are presented. (31 refs.)

118621 The occurrence of separation in oscillatory flow. I.J.Sobey (School of Maths., Univ. of Bristol, Bristol, England).
J. Fluid Mech. (GB), vol.134, p.247-57 (Sept. 1983).
The author uses the results of numerical solutions of the unsteady Navier-Stokes equations to study the occurrence of separation in unsteady flow. The structure of a flow cycle depends strongly on the Strouhal number, whose value can be classified as small, intermediate or large. In each of these regions different effects are calculated, and the author gives guidelines for the boundaries of these regions. In particular, he shows that the small-Strouhal-number region, in which quasi-steady flow is observed, is very small and decreases rapidly as the peak Reynolds number increases. (6 refs.)

118622 Free-surface flows related to breaking waves. M.Greenhow (Dept. of Appl. Maths. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
J. Fluid Mech. (GB), vol.134, p.259-75 (Sept. 1983).
Using the semiLagrangian approach of John (1953), both Longuet-Higgins (1982) and New (1983) have proposed simple analytical models of the underside or loop of a plunging breaking wave. Although New's ellipse model appears to be remarkably accurate both in profile and free-surface particle dynamics for a limited region of the loop, both of the loop models are shown to be deficient because neither correctly accounts for the rest of the wave. On the other hand, Longuet-Higgins (1983) gives a semiLagrangian representation of the Dirichlet hyperbola, previously shown to be relevant to the jet of fluid ejected from the top of a breaking wave (see Longuet-Higgins 1980). The author shows that both this jet flow and the ellipse model of New describing the loop are, for large time, complementary solutions of the same free surface equation. This in turn suggests solutions which combine both the jet and the loop, to give a much more complete model of the entire overturning region not too far from the wave crest, and which has approximately correct free-surface particle velocities and accelerations. (9 refs.)

118623 On surface gravity waves crossing weak current jets. J.Smith (Dept. of Oceanography, Naval Postgraduate School, Monterey, CA, USA).
J. Fluid Mech. (GB), vol.134, p.277-99 (Sept. 1983).
Variations in wave amplitude and steepness across current jets have been described for broad smooth-sided jets. Narrow jets are modelled by a top-hat pattern; an approximate solution is found for linear waves, based on conservation of wave action and vertical averaging. The results join remarkably well to those for a broad cosine-shaped jet (cf. McKee 1975). For jet widths less than about a third of a wavelength, there is little change in amplitude; the enhancement predicted by a WKB analysis is suppressed owing to interference with reflections from the far side of the jet. For directional spectra not too different from $\cos^2\theta$, some suppression occurs near the middle of jets of all scales, owing to exclusion of the glancing wave components by reflection from

the near side; this suppression can be significant for jets more than a wavelength wide. For monochromatic waves, maximum amplitudes occur some distance outside the jet owing to interference; the net reflection appears to have a positive phase shift along the near caustic of about $^1/_4$ cycle. (20 refs.)

118624 Theory of interaction of gravity waves with hydrodynamic turbulence. A.G.Sazontov.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.783-91 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR)*, vol.23, no.6, p.55-65 (Nov.-Dec. 1982). [received: Sept. 1983]
The study of the vortex-wave turbulence with reference to the interaction of gravity waves with vortices is presented. The present problem has a number of special features associated with the fact that surface waves in deep water are dispersive, the phase velocity vϕ is a function of wavelength $\lambda : \nu_{\Phi} = \sqrt{g\lambda}$ (g is the acceleration of gravity, $\lambda = \lambda/2\pi$). The logarithmic decrement for gravity waves propagating at the surface of a turbulent liquid has been found on the basis of computed matrix of interaction coefficients. An estimate of the characteristic phase correlation time and the time for making the wave field isotropic in elastic scattering have been obtained. The diffusion approximation has been used to analyze the effect of inelastic scattering on the development of isotropic wave packets as a function of frequency. The limits of the applicability of kinetic equations to describe the mutual interaction of gravity waves in a turbulent medium have been explained. (20 refs.)

118625 Nonlocal progressive capillary waves of arbitrary amplitude. S.J.Hogan (Univ. of Cambridge, Cambridge, England).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.3, p.271-5 (May-June 1983). [received: Sept. 1983]
A recent paper by Chiroiu (1979) is shown to be incorrect for the case of nonlocal progressive capillary wave propagation on fluid on finite depth. A sketch of the correct solution is given. (9 refs.)

Head-on collisions between solitary surface waves on shallow water: theory and experiment .... See Entry 116996

Buckling, postbuckling, and the flow through a tethered elastic cylinder under external pressure .... See Entry 118458

Propagation of small perturbations in a system consisting of a prestressed compressible solid and a viscous compressible fluid .... See Entry 118483

Gravity currents moving along a lateral boundary in a rotating fluid .... See Entry 118613

Characteristic frequencies of transonic diffuser flow oscillations .... See Entry 118629

Nonlinear unstable wave disturbances in fluidized beds .... See Entry 118669

On transverse secondary flows in wave channels .... See Entry 118680

Anomalous refraction and conjugate solutions of finite-amplitude water waves .... See Entry 121286

47.40 COMPRESSIBLE FLOWS; SHOCK AND DETONATION PHENOMENA

(see also 28.70 Nuclear explosions, 52.35T Plasma shock waves)

118626 Two hidden symmetries of the equations of ideal gasdynamics, and the general solution in a case of non-uniform entropy distribution. B.Gaffet (Section d'Astrophys., CENS, Gif-sur-Yvette, France).
J. Fluid Mech. (GB), vol.134, p.179-94 (Sept. 1983).
Through an extension of the concept of scale invariance the author constructs two invariance transformations of the equations of gasdynamics. The first is a true Backlund transformation, and as such one expects that it should play an important role in the search for new cases of integrability. The second one affects the shape of the entropy profile, implying that the mathematical problems of isentropic and non-isentropic flow are, at least in some cases, equivalent. This enables one to deduce the general solution in closed form, assuming a power-law entropy profile of the form $P/\rho^{\gamma} \approx 1/M^{3\gamma-1}$, where M is the Lagrangian mass coordinate. (9 refs.)

118627 k-ϵ equation for compressible reciprocating engine flow. S.H.El Tahry (General Motors Res. Lab., Warren, MI, USA).
J. Energy (USA), vol.7, no.4, p.345-53 (July-Aug. 1983).
The k-ϵ model currently is being used by several investigators as a submodel for the calculations of turbulent flows in engines using multidimensional procedures. As this submodel mainly was developed and tested for incompressible flows, attempts were made and described in the literature to modify the model to suit engine applications. In these attempts, little effort was made to examine the basic κ and ϵ equations closely. Because these equations contain information that could be quite helpful in developing the model, in the present study the basic k and ϵ equations are examined with an analysis tailored to identify important terms that appear during compression/expansion in engine cylinders. It transpires from the analysis that some terms that were neglected basically in earlier studies could be quite large. Modeling some of these terms in the ϵ equation was relatively straightforwared and did not add any unknown constants. Thus, these terms were added to the ϵ equation in the new model. The remaining terms, which are significant only during combustion, are more complex, and it is doubtful that they could be modeled without the addition of model constants. Because of a lack of data necessary to estimate the model constants, these terms were neglected. A comparison between the new and an earlier version of the model revealed that the new version yielded more physically plausible results. (21 refs.)

118628 Nonlinear stability conditions and a priori estimates for barotropic hydrodynamics. D.D.Holm, J.E.Marsden, T.Ratiu, A.Weinstein (Center for Nonlinear Studies, Los Alamos Nat. Lab., Los Alamos, NM, USA).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.15-21 (3 Oct. 1983).
A method developed by Arnold (1969) to prove nonlinear stability of certain steady states for ideal incompressible flow in two dimensions is extended to the barotropic compressible case. The results are applied to plane shear flow. (21 refs.)

An aeroacoustic model for high-speed, unsteady blade-vortex interaction .... See Entry 118322

The asymptotic solutions of compressible, nonsteady boundary layer .... See Entry 118554

A digitized telemetric system for transient phenomenon measurement [underwater explosion] .... See Entry 118697

Study of charged-particle dynamics during ejection of a reactive jet under orbital flight conditions .... See Entry 121502

47.40H Transonic flows

118629 Characteristic frequencies of transonic diffuser flow oscillations. T.J.Bogar, M.Sajben, J.C.Kroutil (McDonnell Douglas Corp., St. Louis, MO, USA).
AIAA J. (USA), vol.21, no.9, p.1232-40 (Sept. 1983).
The time-mean and unsteady flow characteristics of a supercritical transonic diffuser are investigated as a function of shock Mach number and diffuser length. The flow is either attached or undergoes shock-induced separation, depending on shock strength. The power spectral density distributions of the unsteady shock motion display up to three distinct peaks, depending on flow conditions. For attached flow, the characteristic frequencies scale with the distance from the shock to the diffuser exhaust. Their origin is acoustic and frequencies up to the third harmonic are observed. For shock-induced separation, the single characteristic frequency observed does not follow acoustic predictions. The mechanism of these oscillations may be related to the core flow dimensions or to the spectral amplitude response characteristics of the terminal shock. (20 refs.)

118630 A grid overlapping scheme for flowfield computations about multicomponent configurations. E.H.Atta, J.Vadyak (Lockheed-Georgia Co., Marietta, GA, USA).
AIAA J. (USA), vol.21, no.9, p.1271-7 (Sept. 1983).
An efficient grid interfacing zonal algorithm has been developed for computing the transonic flowfield about three-dimensional multicomponent configurations. The algorithm uses the full-potential formulation and the AF2 fuly implicit approximate factorization scheme. The flowfield solution is computed using a component-adaptive grid approach in which separate grids are employed for the individual components in the multicomponent configuration, where each components grid is optimized for a particular geometry. The component grids are allowed to overlap, and flowfield information is transmitted from one grid to another through the overlap region. An overlapping grid scheme has been implemented for an isolated wing and a noninteracting wing/pylon/nacelle configuration. Numerical results show that the present algorithm is stable, accurate, and promises to be effective in computing the flowfield about complex configurations. (9 refs.)

118631 A least squares finite element scheme for transonic flow around harmonically oscillating airfoils. C.L.Cox, G.J.Fix, M.D.Gunzburger (Dept. of Maths., Carnegie-Mellon Univ., Pittsburgh, PA, USA).
J. Comput. Phys. (USA), vol.51, no.3, p.387-403 (Sept. 1983).
A finite element scheme based on a least squares variational principle is used to calculate the transonic flow field around harmonically oscillating airfoils. The most important features of this procedure are its sensitivity to equation type and the absence of frequency limitation. Sample numerical results are reported including transonic flows containing shocks. (13 refs.)

118632 An extension of the pressure unitary formula, valid both for compression and expansion, over the whole transonic regime ($M_{\infty}>1$). E.Carafoli, S.Tomescu (INCREST, Bucharest, Rumania).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.3, p.245-54 (May-June 1983). [received: Sept. 1983]
The application of a unitary formula valid for compression-expansion in supersonic regime has been extended to Mach numbers in the neighbourhood of $M_{\infty}=1$. To this purpose one computes the values of the pressure coefficients for various δ deviations of the M_{∞} incident flow; the results found are very close to the accurate ones. There are several exemplifications meant for the obtainment of other parameters of the motion, both in the compression case and the expansion case, as a function of the pressure coefficient, C_p. The method also allows,in the compression case, to determine the flow parameters in the neighbourhood of the shock wave detachment over the whole supersonic speed domain. Since remarkable results are obtained in determining the parameters of the supersonic flows in the neighbourhood of $M_{\infty}=1$, the method can be used for determining the pressures on profiles in transonic regime. (2 refs.)

118633 Some remarks on transonic potential flow theory. D.Nixon, G.H.Klopfer (Nielsen Engng. & Res. Inc., Mountain View, CA, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.2, p.270-4 (June 1983).
The validity of the commonly used transonic potential equation for flows with shock waves is examined. It is concluded that in such cases the potential formulation is inconsistent with the basic assumptions of the theory because of the nonconservation of momentum across a shock. The relationship of this momentum source to wave drag is also discussed. Another topic examined is the rationalization of means to make solutions of the transonic potential equation agree better with solutions of the Euler equations. (10 refs.)

Prediction of separated asymmetric trailing-edge flows at transonic mach numbers .... See Entry 118567

Perturbation procedures for nonlinear viscous flows .... See Entry 118639

47.40K Supersonic and hypersonic flows

118634 An efficient, full-potential implicit method based on characteristics for supersonic flows. V.Shankar (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA), S.Osher.
AIAA J. (USA), vol.21, no.9, p.1262-70 (Sept. 1983).
A nonlinear aerodynamic prediction technique based on the full-potential equation in conservation form has been developed for the treatment of supersonic flows. The method uses the theory of characteristic signal propagation to accurately simulate the flow structure, which includes shock waves and mixed elliptic-hyperbolic crossflow. An implicit approximate factorization scheme is employed to solve the finite-differential equation. The necessary body-fitted grid system in every marching plane is generated numerically, using an elliptic grid solver. Results are shown for conical and nonconical wing-body combinations and compared with experimental data and Euler calculations. The method demonstrates an enormous saving in execution time and memory requirements over Euler methods. (15 refs.)

118635 Supersonic turbulent boundary layers subjected to a pressure gradient: calculation with a k-ϵ model. J.M.Galmes (Inst. de Mecanique Statistique de la Turbulence, Marseille, France), J.P.Dussauge, I.Dekeyser.
J. Mec. Theor. & Appl. (France), vol.2, no.4, p.539-58 (1983). In French.
The computation of supersonic turbulent boundary layers subjected to positive or negative pressure gradients is presented. A two equation model of turbulence (k-ϵ) is used; the turbulent shear stress is obtained from the Boussinesq hypothesis. The role of compressibility is discussed and the authors modify the model to take such effects into account. For accelerated or decelerated supersonic flows, source terms involving mean dilatation and mean pressure gradient terms are introduced in the equations of k and ϵ. Computation results are compared with measurements obtained in various experiments. (7 refs.)

118636 Numerical determination of the parameters of high entropy layers in bodies with a small degree of bluntness in supersonic flow. V.I.Timoshenko.
Zh. Vychisl. Mat. & Mat. Fiz. (USSR), vol.23, no.4, p.947-53 (July-Aug. 1983). In Russian. English translation in: *USSR Comput. Math. & Math. Phys. (GB)*
Singularities are analysed in the application of finite difference methods for the calculation of supersonic flow of bodies with a low degree of bluntness associated with the determination of parameters of a gas in a thin entropy layer at the surface of the body. An algorithm is proposed, and the results of calculating the parameters in a high entropy layer are presented. The results can be used in the solution of a problem of vortex interaction. (9 refs.)
A.G.C.

Investigation of jet flow past slotted and wedge-shaped nozzles in a shock tube [of relevance to gasdynamic lasers] ....See Entry 118654

47.40N Shock-wave interactions

118637 Performance study of shock tubes with area change at the diaphragm section. Effects on the shock tube performance of diaphragm location, area ratio and convergent angle. H.Sugiyama (Muroran Inst. of Technol., Muroran, Japan).
Bull. JSME (Japan), vol.26, no.216, p.958-63 (June 1983).
Shock tubes with area change at diaphragm section have been widely used in many engineering fields, but the performance of such shock tubes is not sufficiently well known, especially about the effects on the performance of the diaphragm location and a the shape of convergent section. The effects on the performance of the diaphragm location, area ratio and convergent angle have been experimentally studied, and the results given. (12 refs.)

118638 Simulation of detonation cell kinematics using two-dimensional reactive blast waves. G.O.Thomas, D.H.Edwards (Dept. of Phys., Univ. Coll. of Wales, Aberystwyth, Wales).
J. Phys. D (GB), vol.16, no.10, p.1881-92 (14 Oct. 1983).
An improved method of generating a cylindrical blast wave is described which overcomes the disadvantages inherent in the converging-diverging nozzle technique previously used by the authors (1981). A diverging detonation vessel was constructed from two sheets of glass and two Tufnol blocks which form a variable-angle sector. An exploding wire, placed at the apex of the sector, was used to generate blast waves of variable strength. The trajectory of the shock wave and the density field behind the front was recorded by a streak-Schlieren interferometer. It is shown that the observed velocity profile simulates the behaviour of that found in freely propagating detonations satisfactorily. Moreover it is confirmed that the post-shock density decay parameter has a constant value of 4 which is in accord with previous studies; it is suggested that this is a universal value in detonation cells. (14 refs.)

118639 Perturbation procedures for nonlinear viscous flows. D.Nixon (Nielsen Engng. & Res. Inc., Mountain View, CA, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.2, p.265-9 (June 1983).
The perturbation theory for transonic flow is further developed for solutions of the Navier-Stokes equations in two dimensions or for experimental results. The strained coordinate technique is used to treat changes in location of any shock waves or large gradients. (7 refs.)

Numerical experiments with the Osher upwind scheme for the Euler equations ....See Entry 118544

Mathematical models and computing algorithms for the flow of a viscous fluid ....See Entry 118545

Boundary-layer and turbulence intensity measurements in a shock wave/boundary-layer interaction .... See Entry 118568

Characteristic frequencies of transonic diffuser flow oscillations ....See Entry 118629

An extension of the pressure unitary formula, valid both for compression and expansion, over the whole transonic regime ($M_\infty > 1$) ....See Entry 118632

Some remarks on transonic potential flow theory .... See Entry 118633

Spurt of gas from a hole into air ....See Entry 118651

Design of supercritical cascades with high solidity .... See Entry 118687

Nonequilibrium radiative heating of an ablating Jovian entry probe ....See Entry 121496

47.45 RAREFIED GAS DYNAMICS

(see also 07.30 Vacuum production and techniques)

118640 Rarefied gas flow in a cylindrical annulus. S.S.Lo, S.K.Loyalka, T.S.Storvick (Coll. of Engng., Univ. of Missouri, Columbia, MO, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1539-48 (1983).
The Hansen-Morse model (1967) of the linearized Wang Chang-Uhlenbeck equation is used to study the thermal transpiration and mechanocaloric effects for rarefied polyatomic gases in a cylindrical annulus, where boundary conditions are characterized by diffuse reflection. Phenomenological coefficients at all degrees of rarefaction are reported for physical parameters that represent helium, hydrogen, carbon dioxide, and air. Comparisons with isothermal flow data are given. (33 refs.)

118641 Thermal polarization of bodies in the rarefied gas flow. S.P.Bakanov, V.V.Vysotskij, B.V.Derjaguin, V.I.Roldughin (Dept. of Surface Phenomena, Inst. of Phys. Chem., Acad. of Sci., Moscow, USSR).
J. Non-Equilibrium Thermodyn. (Germany), vol.8, no.1, p.75-83 (1983).
A new phenomenon, the thermal polarization of bodies in a rarefied gas flow, has been predicted theoretically and detected experimentally. In accordance with Onsager's principle of symmetry, the phenomenon is connected with thermophoresis in gas. The measurement of the thermal polarization effect provides a possibility for determining the values of the momentum and energy accommodation coefficients of gas molecules on the surface of solid and liquid bodies. The experimental detection of the thermal polarization of bodies is a substantial contribution to the theoretical substantiation of the applicability of irreversible thermodynamics methods to the description of some phenomena in the region where the hydrodynamic approximation is not valid. (14 refs.)

118642 Compatibility criteria for generalized Boltzmann equations. C.C.A.Sastri (Dept. of Maths., Statistics & Computing Sci., Dalhousie Univ., Halifax, NS, Canada).
Nuovo Cimento B (Italy), vol.77B, ser.2, no.1, p.42-8 (11 Sept. 1983).
It is suggested that long-range correlations in a rarefied gas can be described by a hierarchy of generalized Boltzmann equations which, unlike either the Liouville equation or the BBGKY hierarchy, take the rarefaction of the gas into account and are presumably easier to handle. The equations are postulated, and compatibility criteria for their truncation as well as a class of truncations are proposed. The work presented here can be regarded as a further step toward a kinetic theory of turbulence (for rarefied gases) along the lines of Zhigulev (1966) and Tsuge (1970). (15 refs.)

Thermal polarization of solids in a rarefied gas flow .... See Entry 118661

Net molecular flow conductance of series elements .... See Entry 118674

Evaporation of metals by a high-energy-density source .... See Entry 119168

Study of charged-particle dynamics during ejection of a reactive jet under orbital flight conditions ....See Entry 121502

47.50 NON-NEWTONIAN DYNAMICS

118643 Slow flow of a non-Newtonian fluid past a micro-capsule. P.O.Brunn, J.Gilbert, D.Jiji (Dept. of Chem. Engng. & Appl. Chem., Columbia Univ., New York, NY, USA).
Appl. Sci. Res. (Netherlands), vol.40, no.3, p.253-70 (1983).
The streaming motion past a spherical microcapsule is studied. The particle consists of a thin elastic membrane enclosing an incompressible fluid. Since the problem is highly nonlinear, a perturbation solution is sought in the limiting case where the deviation from sphericity is small. Obviously, the capsule remains nearly spherical when λ, the ratio of viscous forces to elastic (shape-restoring) membrane forces is small. In this limit, the rheology of the inside fluid is immaterial and the problem is essentially characterized by three parameters: λ, the Reynolds number Re (interia effect), and the Weissenberg number We (nonNewtonian effect). The deformation is obtained explicitly under the restriction $We<1$, $Re<1$. It is shown that to leading order, the capsule deforms exactly into a spheroid which can be either oblate or prolate, depending mainly upon the elasticity number We/Re: for $We/Re<0.57$ the spheroid is oblate, while for $We/Re>0.81$ a prolate spheroid results. For $0.57<We/Re<0.81$ additional details of the rheology of the membrane and of the suspending fluid are needed. (14 refs.)

118644 Effect of pipe diameter on polymer drag reduction. R.H.J.Sellin, M.Ollis (Dept. of Civil Engng., Univ. of Bristol, Bristol, England).
Ind. & Eng. Chem., Prod. Res. & Dev. (USA), vol.22, no.3, p.445-52 (Sept. 1983).
Tests were conducted in six different pipe diameters (from 1 to 50 mm) with the same polymer. This was a polyacrylamide of only moderate drag reducing ability to ensure that the onset point could be determined directly wherever possible and that the results in the polymeric zone were unaffected by the maximum drag reduction region. Standardized solution preparation was adopted throughout and Granville's method of scale-up proved, with some limitations, to give the best and most convenient method of performance prediction. Attempts to explain drag reduction differences between large and small pipes were only partially successful. (12 refs.)

118645 Heat transfer in the flow of a second-order fluid under an enclosed rotating disc. H.G.Sharma, K.R.Singh (Dept. of Math., Univ. of Roorkee, Roorkee, India).
Indian J. Technol., vol.21, no.3, p.101-4 (March 1983). [received: Oct. 1983]
The problem of heat transfer in the steady flow of an incompressible second-order fluid under an enclosed rotating disc has been discussed. The effects of elastico-viscosity and cross-viscosity of the fluid on the temperature profile and Nusselt numbers on the rotor and stator for radial outflow and inflow have been investigated in the regions of no-recirculation and recirculation. (11 refs.)

118646 Flow of a non-Newtonian second-order fluid between two infinite torsionally oscillating discs. H.G.Sharma, D.S.Gupta (Dept. of Maths., Univ. of Roorkee, Roorkee, India).
Indian J. Pure & Appl. Math., vol.14, no.9, p.1091-9 (Sept. 1983).
The flow of an incompressible second-order fluid due to torsional oscillations of two infinite discs has been considered by expanding the velocity components and the pressure in powers of the amplitude of oscillation. The transverse and radial flows are investigated in detail. It is found that the effects of second-order forces increase the amplitude of the oscillation of the axial velocity. The steady part of velocity components for small values of Reynolds number have been studied and shown graphically. The transverse shearing stress and moment on the discs have also been obtained. (8 refs.)

118647 Perturbation theory for viscoelastic fluids between eccentric rotating cylinders. A.Beris, R.C.Armstrong, R.A.Brown (Dept. of Chem. Engng., MIT, Cambridge, MA, USA).
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.2, p.109-48 (Sept. 1983).
The circumferential and radial profiles of velocity, pressure and stress are derived for the flow of model viscoelastic liquids between two slightly eccentric cylinders with the inner one rotating. Singular perturbation methods are used to derive expansions valid for small gaps between the cylinders, but for all Deborah numbers. Results for Newtonian, second-order, Criminale-Ericksen-Filbey, upper-convected Maxwell, and White-Metzner constitutive equations separate the effects of elasticity, memory, and shear thinning on the development of the large stress gradients that hinder numerical solutions with these models in more complicated geometries. The effect of the constitutive equation on the critical Deborah number for flow separation is presented. (32 refs.)

118648 Squeezing flow of elastic liquids. M.A.McClelland, B.A.Finlayson (Dept. of Chem. Engng., Univ. of Washington, Seattle, WA, USA).
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.2, p.181-201 (Sept. 1983).
A theoretical analysis is made of the relation between applied force and plate separation for squeezing flows of viscoelastic liquids between closely-spaced parallel disks. The lubrication approximation and the quasisteady-state assumption are employed in the development. Elastic effects are incorporated through inclusion of normal stresses. Solutions are presented for liquids with power-law viscometric functions, and a numerical procedure is used for fluids having viscometric functions of arbitrary form. For fast and slow squeezing, calculated values of $t_{1/2}$, the time required to squeeze out half the fluid, agree with the constant force data of Leider (1973, 1974). (21 refs.)

Pool boiling of drag-reducing polymer solutions ....See Entry 118363

Turbulence induced change in the conformation of polymer molecules ....See Entry 118571

Some remarks on 'Drag coefficients of a slowly moving sphere in non-Newtonian fluids' [and reply] ....See Entry 118663

Extrudate swell for a round jet with large surface tension .....See Entry 118676

47.55 NONHOMOGENEOUS FLOWS

118649 Shape and stability of a liquid drop moving at low Weber numbers. I.Frankel, D.Weihs (Dept. of Aeronautical Engng., Technion-Israel Inst. of Technol., Haifa, Israel).
Appl. Sci. Res. (Netherlands), vol.40, no.3, p.279-94 (1983).
The equilibrium cross sectional shape and stability of a liquid drop moving in a gaseous medium is studied analytical. Such liquid drops appear as the final product in numerous industrial spraying and atomisation processes. Raindrops falling at their terminal speed can also be described by the present model. The equilibrium shape is formed by the interaction of two factors: the dynamic pressure distribution in the gaseous medium which tends to deform the liquid drop into an oblate shape and the surface tension which tends to restore the spherical shape. The meridional shape of the liquid drop is obtained as a power series in the Weber number. The linear stability of the deformed shapes described above to small surface disturbances is studied. The stability analysis shows the effect of the surrounding gas flow on the natural frequencies of oscillation (vibration) of the liquid drop. (19 refs.)

118650 The creeping motion of immiscible drops through a converging/diverging tube. W.L.Olbricht, L.G.Leal (Dept. of Chem. Engng., California Inst. of Technol., Pasadena, CA, USA).
J. Fluid Mech. (GB), vol.134, p.329-55 (Sept. 1983).
Results of experiments on the low-Reynolds-number flow of liquid drops through a horizontal circular tube with a diameter that varies sinusoidally with axial position are reported. Measurements of the contribution of the drop to the local pressure gradient and the relative velocity of the drop are correlated with the time-dependent drop shape. Both Newtonian and viscoelastic suspending fluids are considered. The viscosity ratio, volumetric flow rate and drop size are varied in the experiment, and both neutrally buoyant and non-neutrally buoyant drops are studied. Comparison with previous results for a straight-wall tube shows that the influence of the tube boundary geometry on the drop shape is substantial, but the qualitative effect of the tube shape depends strongly on the relative importance of viscous forces compared to interfacial tension for the particular experiment. For Newtonian fluids, two modes of drop breakup, which are distinguished by the magnitude of the viscosity ratio, are observed. When the suspending fluid is viscoelastic, both shear-thinning and time-dependent rheological effects are present. (32 refs.)

47.55C Jets

118651 Spurt of gas from a hole into air. A.Sakurai (Coll. of Sci. & Engng., Tokyo Denki Univ., Saitama, Japan), F.Takayama.
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.2963-5 (Sept. 1983).
Results of experimental and numerical investigations on the behaviour of spurting gas from a hole into air are analysed to show that a salient feature of the flow characteristics of the air can be described by the point source blast wave theory. (6 refs.)

118652 The 'whistler-nozzle' phenomenon. A.K.M.F.Hussain, M.A.Z.Hasan (Dept. of Mech. Engng., Univ. of Houston, Houston, TX, USA).
J. Fluid Mech. (GB), vol.134, p.431-58 (Sept. 1983).
The 'whistler nozzle' is a simple device which can induce jet self-excitations of controllable amplitudes and frequencies and appears highly promising for many applications involving turbulent transport, combustion and aerodynamic noise. This paper documents the characteristics of this curious phenomenon for different values of the controlling parameters and explains the phenomenon. It is shown that the whistler excitation results from the coupling of two independent resonance mechanisms: shear-layer tone resulting from the impingement of the pipe-exit shear layer on the collar lip, and organ-pipe resonance of the pipe nozzle. The crucial role of the shear-layer tone in driving the organ-pipe resonance is proven by reproducing the event in pipe-ring and pipe-hole configurations in the absence of the collar. It is also shown that this phenomenon is strongest when the self-excitation frequency matches the 'preferred mode' of the jet. The 'whistler-nozzle' phenomenon occurs for both laminar and turbulent initial boundary layers; the excitation can be induced without the pipe nozzle (say, by ring or hole tone) when the exit flow is laminar but not when it is turbulent. (33 refs.)

118653 Plane jet interaction with three-dimensional disturbances. N.M.Terekhova.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.796-803 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR)*, vol.23, no.6, p.69-76 (Nov.-Dec. 1982). [received: Sept. 1983]
The interaction of oblique disturbances in the form of intersecting oblique Tollmien-Schlichting waves of finite amplitude with the plane flow without solid boundaires, viz. laminar jet with Bickley-Schlichting velocity profile has been considered. On the basis of an accurate solution of Reynolds equations, longitudinal vortices and secondary mean flow have been found and it has been shown that the momentum redistribution in such an interaction from the jet axis to the outer region agrees with the experimental results. The secondary flow happens to be more stable than the basic flow. The interaction of plane waves and the flow is the critical factor for excitation in the transition region. (13 refs.)

118654 Investigation of jet flow past slotted and wedge-shaped nozzles in a shock tube [of relevance to gasdynamic lasers]. V.V.Golub, V.V.Grigor'ev, Yu.I.Grin', S.N.Isakov, I.M.Naboko, R.L.Petrov, V.G.Testov.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.803-7 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR)*, vol.23, no.6, p.76-80 (Nov.-Dec. 1982). [received: Sept. 1983]
Results are given for experimental studies on three-dimensional and plane jets in shock tubes under conditions similar to those in which studies on the laser characteristics of gas flows were conducted: transient time for the density field and the flow geometry, spatial characteristics of density distribution. (8 refs.)

118655 Measurements of turbulent Prandtl number in a plane jet. L.W.B.Browne, R.A.Antonia (Dept. of Mech. Engng., Univ. of Newcastle, Newcastle, NSW, Australia).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.663-5 (Aug. 1983).
Jenkins and Goldschmidt (1973) presented data, obtained from several sources, of spreading parameters for turbulent plane and circular jets into still air. Although relatively wide variations were evident in individual spread rates for temperature and velocity fields, the ratio of these spread rates was constant, the constant being slightly larger for the plane jet (1.42) than the circular jet (1.22). There are few measurements of momentum and heat fluxes in both plane and circular jets. In a plane jet, Jenkins and Goldschmidt (1974) found that conditional averages, in the turbulent part only of the flow, of turbulent momentum and thermal diffusivities were approximately constant. The ratio of these diffusivities or turbulent Prandtl number Pr_t was also approximately constant (equal to 0.4) in the intermittent region of the jet and showed a tendency to increase towards the centerline. Van der Hegge Zijnen (1957) had calculated Pr_t using measured mean velocity and mean temperature profiles in a plane jet. The calculation showed that Pr_t was 0.6 at the centerline, decreased to about 0.4 where the flow became intermittent before increasing through the intermittent region to a value of about 1.0. The authors present measured values of Pr_t in the selfpreserving region of a slightly heated plane jet and discuss them in the context of previously reported distributions for Pr_t. (11 refs.)

Noise generation by a low-Mach-number jet .... See Entry 118323

Multiple scale concept in turbulence modelling. II. Reynolds stresses and turbulent fluxes of a passive scalar, algebraic modelling and simplified models using the Boussinesq hypothesis .... See Entry 118570

On the organized motion of a turbulent plane jet .... See Entry 118572

The destruction of temperature fluctuations in a turbulent plane jet .... See Entry 118573

Free-surface flows related to breaking waves .... See Entry 118622

On surface gravity waves crossing weak current jets .... See Entry 118623

Extrudate swell for a round jet with large surface tension ..... See Entry 118676

The laser irradiated gas jet: A spectroscopic experimental and theoretical study .... See Entry 118737

Study of charged-particle dynamics during ejection of a reactive jet under orbital flight conditions .... See Entry 121502

47.55E Nozzles

The 'whistler-nozzle' phenomenon .... See Entry 118652

Investigation of jet flow past slotted and wedge-shaped nozzles in a shock tube [of relevance to gasdynamic lasers] .... See Entry 118654

Diffusive, electrostatic, and gravitational deposition of suspensions in the entrance of a nozzle .... See Entry 118665

47.55H Stratified flows

118656 Adjacent flow of two immiscible dusty fluids. E.C.Sekharan, G.Ramanaiah (Dept. of Math., Madras Inst. of Technol., Madras, India).
Indian J. Technol., vol.21, no.3, p.89-93 (March 1983). [received: Oct. 1983]
Unsteady, adjacent, laminar flow of two immiscible dusty viscous fluids between two infinitely long parallel plates driven by a constant pressure gradient is considered. Finite difference technique has been applied to obtain numerical solutions for velocities of fluids and dust particles. Also the stress at the two plates and at the interface and the volume flow rates have been computed and the influence of dust parameters on these values are investigated. In each case the results are compared with those of clean fluids. (7 refs.)

118657 Prediction of the transit time of a stably stratified flow in a channel with inclined surface. Seung Oh (JAYCOR Inc., San Diego, CA, USA), B.K.H.Sun.
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.666-7 (Aug. 1983).
A simple correlation based on mechanistic approaches was developed for the prediction of transit time of a stably stratified flow in a channel with an inclined surface. It is shown that the model is able to correlate all the data of Rothe and Marscher (1982) for a wide range of test conditions. (7 refs.)

Introduction to two-dimensional turbulence .... See Entry 118562

The structure of turbulence in homogeneous and stratified rotating fluids .... See Entry 118607

47.55K Multiphase flows

118658 On the steady state performance of cocurrent bubble column slurry reactors. V.M.H.Govindarao, M.Chidambaram (Dept. of Chem. Engng., Indian Inst. of Sci., Bangalore, India).
Chem. Eng. J. (Switzerland), vol.27, no.1, p.29-36 (Aug. 1983).
On the basis of the dispersion model for the gas and liquid phases and the sedimentation-diffusion model for the solid phase, the steady state performance of an isothermal cocurrent flow bubble column slurry reactor with a first-order surface reaction is analysed. The system equations are solved using the orthogonal collocation method. Numerical evaluation shows that the effects of slurry phase mixing are very significant whereas the effects of gas phase mixing are negligible. Conversion of the gas component increases with decrease in the slurry phase backmixing. This enhancement in the conversion is more pronounced at higher particle sizes and lower catalyst loadings. The conversion reaches a minimum with respect to the particle size, showing that specified conversions can be obtained with larger particles also. (9 refs.)

118659 Fluid motion and mixing in a gas-liquid contactor with turbine agitators. Y.Nagase, H.Yasui (Dept. of Chem. Engng., Hiroshima Univ., Hiroshima, Japan).
Chem. Eng. J. (Switzerland), vol.27, no.1, p.37-47 (Aug. 1983).
Gas bubble distributions, estimated from local holdup measurements, and flow profiles near the vessel wall, deduced from wall pressure measurements, were used to present a physically sound understanding of the entire flow profiles in an aerated agitation vessel with either a disc turbine or a vaned disc turbine. Essentially a single impeller speed with gas rates Q_a greater than 0.05 nd^3 was used. Typical findings were that (1) the flow field under the impeller was quite similar to that for unaerated agitation, (2) the circulation flow of liquid over the impeller was fairly restricted even with a disc turbine and (3) another narrow but steady circulation zone was formed near the wall between the liquid surface and the impeller. Mixing measurements under aeration for comparison with single-phase measurements obtained at lower speeds to maintain the same total power input confirmed point (1) above, although the total mixing rate was reduced by about 20%-30% compared with that for unaerated conditions. (18 refs.)

118660 Reciprocity theorems for a nonuniform medium. V.I.Roldugin (Inst. of Phys. Chem., Acad. of Sci., Moscow, USSR).
Colloid J. USSR (USA), vol.44, no.6, p.969-75 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1102-8 (Nov.-Dec. 1982). [received: Sept. 1983]
It has been shown that the mutuality theorems established previously within the framework of Navier-Stokes hydrodynamics lead to contradictions in the case of movement of solids in a nonuniform liquid. The Newton-Fick-Fourier laws have been modified in order to describe correctly the dynamics of solid bodies in a nonuniform liquid. A derivation is given for new reciprocity theorems from modified transport equations. (8 refs.)

118661 Thermal polarization of solids in a rarefied gas flow. S.P.Bakanov, V.V.Vysotskii (Dept. of Surface Phenomena, Acad. of Sci., Moscow, USSR).
Colloid J. USSR (USA), vol.44, no.6, p.1014-16 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1156-8 (Nov.-Dec. 1982). [received: Sept. 1983]
The thermal polarization of solids in a rarefied gas flow, predicted from theory has been investigated experimentally. The experimental results have corroborated the correctness of the physical concepts forming the basis of the theory. The coefficients of thermal slip, energy accommodation, and tangential pulse have been determined for argon and helium atoms on glass. (1 ref.)

118662 Effect of boundary absorption upon longitudinal dispersion in shear flows. R.Smith (Dept. of Appl. Maths. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
J. Fluid Mech. (GB), vol.134, p.161-77 (Sept. 1983).
Boundary absorption causes a depletion of contaminant. Since the boundary tends to be the region of lowest velocity and of strongest shear, the remaining contaminant experiences on average an increased advection velocity, a reduced rate of shear dispersion, and a tendency to develop skewness towards the rear. The author shows how all these effects can be incorporated into a delay-diffusion description of the longitudinal dispersion process (Smith 1981). It is the accurate reproduction of the skewness that permits a delay-diffusion equation to become applicable at an earlier stage than the more conventional diffusion-equation models for longitudinal dispersion, and before there has been an undue loss of contaminant through the boundary. (19 refs.)

118663 Some remarks on 'Drag coefficients of a slowly moving sphere in non-Newtonian fluids' [and reply]. R.P.Chhabra (Dept. of Chem. Engng., Univ. Coll. of Swansea, Swansea, Wales), Y.I.Cho, J.P.Hartnett.
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.2, p.225-31 (Sept. 1983).
In a recent paper, Cho and Hartnett (ibid., vol.12, no.2, p.243, 1983) revisited the problem of creeping motion of a rigid sphere in a power-law liquid. The main contribution of the paper seems to lie in the fact that the upper and lower bounds on the drag force experienced by a sphere in power-law liquids obtained by Cho and Hartnett represent a small degree of improvement over those obtained by Wasserman and Slattery (1964). The upper bound (corresponding to the ratio of viscosity of dispersed phase to viscosity of continuous phase equal to 1000) coincides with that given by Cho and Hartnett in the range $1>n>0.5$. Likewise, it is now generally agreed that the original calculations of lower bound given by Wasserman and Slattery are in error and, in fact, corrected results based on a three-parameter stress profile were obtained, by Mohan and Venkateshwarlu and independently by Yoshioka and Adachi (1977/8). Indeed the trial stress profile employed by Cho and Hartnett is a special case of that used by Mohan and Venkateshwarlu (1976). Cho and Hartnett have not presented a comparison between theory and experiments to substantiate their analysis, although a considerable amount of experimental data are available in the literature. In Chhabra's view such a comparison provides the most direct assessment of any theoretical treatment. Such a comparison is presented. Cho and Hartnett respond to Chhabra's criticism. (25 refs.)

118664 On two phase filtration under gravity and with boundary infiltration: application of a Backlund transformation. C.Rogers (Dept. of Appl. Maths., Univ. of Waterloo, Waterloo, Ontario, Canada), M.P.Stallybrass, D.L.Clements.
Nonlinear Anal. Theory, Methods & Appl. (GB), vol.7, no.7, p.785-99 (1983).
A nonlinear boundary value/initial value problem is presented which describes one-dimensional two-phase flow under gravity in a semi-infinite porous reservoir with constant boundary injection. The problem is reduced to a linear boundary value/initial value problem via the application of two successive Backlund transformations. (3 refs.)

118665 Diffusive, electrostatic, and gravitational deposition of suspensions in the entrance of a nozzle. T.A.Korjack (Energy Conversion Res. Section, Philadelphia Electric Co., Philadelphia, PA, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.1-7 (March 1983). [received: Oct. 1983]
An analytical investigation of the mechanics of deposition affected by gravity, electrostatic charge, and Brownian motion in an effuser from the nozzle inlet to a distance where incompressible effects are still valid has been made and a mathematical model developed for the deposition process. The analysis was restricted to laminar flow of dilute, nonreactive suspensions contained with an incompressible, viscous carrier. The results show that increasing the nozzle angle causes a decrease in deposition rate regardless of the diffusive Peclet number and gravity flow parameter. Furthermore, an increase in gravity field causes an increase in bottom deposition rate and decrease in top deposition rate. (12 refs.)

118666 Metering of gas-liquid two-phase flow by sharp-edged orifices and the effect of fluid compressibility on experimental results. Zhao Zaisan, Chang Yunfa, Xu Yinlong, Chen Zhihang (Shanghai Inst. of Mech. Engng., Shanghai, China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.45-52
Previous work by various workers on the subject is reviewed and, using separated flow momentum model, a theoretical analysis of the gas-liquid two-phase flow through sharp-edged orifices is made. From the two-phase flow differential equation as applied to an incompressible fluid, the basic equation of the separated flow model for a two-phase mixture passing through a sharp-edged orifice is derived. The effect of the difference in the values of the area ratio m of the orifice on the experimental results is also dealt with and a conclusion is reached that the effect of m on the experimental results arises mainly from the compressibility of the two-phase fluid. (19 refs.)

10th Annual Conference of the Association for Aerosol Research (Gesellschaft fur Aerosolforschung) .... See Entry 116920

Tagged particle fluctuations in uniform shear flow .... See Entry 117126

Fokker-Planck and Langevin descriptions of fluctuations in uniform shear flow .... See Entry 117127

Heat and mass transfer in a disperse nonequilibrium chemically reacting two-phase flow in a vertical channel .... See Entry 117635

Numerical solution of a Rayleigh-Taylor instability problem .... See Entry 118558

Heat transfer in porous media heated from above with evaporation, condensation, and capillary effects .... See Entry 118596

Adjacent flow of two immiscible dusty fluids .... See Entry 118656

Single-blow transients in packed-bed storage units with solid-phase conduction by Crump's numerical inversion of Laplace transforms .... See Entry 118670

47.55M Flow through porous media

118667 Evaluation of steady flow profiles in rectangular and circular packed beds by a variational method. D.Vortmeyer, J.Schuster (Fakultat fur Maschinenwesen, Tech. Univ. Munchen, Munchen, Germany).
Chem. Eng. Sci. (GB), vol.38, no.10, p.1691-9 (1983).
The Brinkman equation is solved by an equivalent variational problem in order to obtain steady flow profiles which satisfy the conditions $w=0$ and $\epsilon=1$ at the container wall of a packed bed. The quite large deviations between calculated and measured profiles are fully explained. An analytical expression is developed with sufficient accuracy. The main body of calculations is performed for isothermal flow, however flows under non-isothermal conditions also are considered. (29 refs.)

118668 Mass transfer studies in porous electrodes: application of the limiting current technique. M.Benzina (Ecole Nat. D'Ingenieurs de Gabes, Gabes, Tunisia), D.Mowla, G.Lacoste.
Chem. Eng. J. (Switzerland), vol.27, no.1, p.1-7 (Aug. 1983).
The limiting current technique is used to obtain the liquid-solid mass transfer coefficient in two types of fixed electrochemical reactor at low Reynolds numbers. The first reactor is a cylindrical radial flow porous electrode, and the other is a conical axial flow porous electrode. In each case the porous electrode is made of copper particles which are percolated by a dilute solution of Cu^{2+} ions in a sulphuric acid medium. On calculating the electrode yield by measuring the inlet and outlet concentration of electroactive agent, the authors found a correlation between the Reynolds number Re and the Sherwood number Sh. With the present operating conditions, for $0<\mathrm{Re}<45$, $\mathrm{Sh}=2.277\ \mathrm{Re}^{1/3}\mathrm{Sc}^{1/3}$. (18 refs.)

118669 Nonlinear unstable wave disturbances in fluidized beds. J.T.C.Liu (Div. of Engng., Brown Univ., Providence, RI, USA).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1797, p.331-47 (8 Oct. 1983).
Instabilities in fluidized beds are interpreted from the two-phase continuum theory of linearized hydrodynamic stability as the result of interactions between wave hierarchies for which the stability condition is violated; that is, in which the lower-order waves. For weak nonlinearities a hierarchy of burgers-like equations is obtained. The nonlinear modifications to the wave speeds point towards the restoration of the stability condition in the linearized sense. A weakly nonlinear hydrodynamic stability analysis yields an amplitude equation that is of second order. It is argued, however, that the major history of the disturbance development may be expressed by a simpler first-order amplitude equation. The Landau-Stuart constant obtained is intimately related to the nonlinear modifications of the wave speeds of the higher-and lower-order wave operators. It is shown that for supercritical disturbances, amplitude and phase velocity equilibration is possible, and that the levels of the equilibration depend on the initial amplification rate, in agreement with observations. The equilibration occurs by cascades of the fundamental wave disturbance into its harmonics. (27 refs.)

118670 Single-blow transients in packed-bed storage units with solid-phase conduction by Crump's numerical inversion of Laplace transforms. P.-C.Lu (Dept. of Mech. Engng., Univ. of Nebraska, Lincoln, NE, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.493-7 (Aug. 1983).
A robust and fast scheme for the numerical inversion of Laplace transforms, recently established by Crump, is applied to the linear problem of two-phase (solid-and-fluid) response of a packed-bed thermal storage unit during a single-blow operation, with solid conduction in the flow direction properly considered (while neglecting the conduction and energy storage in the fluid). The scheme is shown to be capable of handling implicit solutions in the transformed domain, which are themselves to be calculated numerically on a computer. The numerical results compare very well with those obtained by other methods of attack. The comparison also discloses some rather large errors in a set of data generated by a finite difference scheme as reported in the literature. (14 refs.)

118671 Analysis of coolant entrance boundary shape of porous region to control cooling along exit boundary. R.Siegel, A.Snyder (Lewis Res. Center, NASA, Cleveland, OH, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.513-18 (Aug. 1983).
A cooled porous region has a plane surface exposed to a specified spatially varying heat flux. The coolant leaves the region through this surface, and it is desired to control the flow distribution to maintain a specified uniform surface temperature. This is accomplished by having the coolant entrance surface shaped to provide in the region the necessary variation of path length and, hence, flow resistance. The surface shape at the coolant entrance is found by solving a Cauchy boundary value problem. An exact solution is obtained that will deal with a wide variety of heating distributions for both two- and three-dimensional shapes. (7 refs.)

Study of nonlinear convection in a sparsely packed porous medium using spectral analysis .... See Entry 118583

Numerical study of transient high Rayleigh number convection in an attic-shaped porous layer .... See Entry 118595

Heat transfer in porous media heated from above with evaporation, condensation, and capillary effects .... See Entry 118596

Transient and steady-state natural convection in a porous medium between two concentric cylinders .... See Entry 118603

On two phase filtration under gravity and with boundary infiltration: application of a Backlund transformation .... See Entry 118664

Study of the porous structure and selective properties of membranes obtained by plasma polymerization in a glow discharge .... See Entry 120671

47.60 FLOWS IN DUCTS, CHANNELS, AND CONDUITS

(for biological fluid dynamics, see 87.45)

118672 Longitudinal vortices in wind tunnel wall boundary layers. S.Mokhtari, P.Bradshaw (Dept. of Aeronautics, Imperial Coll., London, England).
Aeronaut. J. (GB), vol.87, no.866, p.233-6 (June-July 1983).
Longitudinal vortices in wind tunnel wall boundary layers near the centre line of each wall have been found. This is important in wind tunnels whose contraction ratios are not sufficiently large for the boundary layer thickness at exit to be negligible. The phenomena was experimentally investigated. The main result is that the thickening and distortion of the wind tunnel floor boundary caused by longitudinal vortices is not necessarily visible at the contraction exit. This is a warning against the assumption that because the boundary layer at the exit is normal it will remain normal thereafter. (7 refs.)

118673 A test of the validity of Jenike's velocity profiles. A.M.Munawer (Dept. of Chem. Engng., Mehran Univ. of Engng. & Technol., Jamshoro, Pakistan).
Mehran Univ. Res. J. Eng. & Technol. (Pakistan), vol.2, no.1, p.39-42 (Jan. 1983). [received: Sept. 1983]
The radial flow stress fields and velocity profiles of Jenike and Shield (see Journal of Appl. Mechs., vol.26, p.599, 1959) have been used in the theory for the rate of dissipation due to the internal friction and wall friction in the flow in a cone. The validity of Jenike's velocity profiles is tested by comparing the total loss of potential energy of material flowing through two spherical control surfaces. The result is that if the Jenike velocity profiles are valid then the ratio of potential energy change to energy dissipation should be one. The sensitivity of the energy balance to the velocity profile is also tested by assuming simple linear dimensionless velocity profiles. This shows that energy balance is very sensitive to the velocity profile mainly because it depends on an interaction between the gradient of the velocity profile and the amount of material through the elements of larger cross-section nearer the hopper wall which also depends on the velocity profile. (4 refs.)

118674 Net molecular flow conductance of series elements. V.E.Stubblefield (McDonnell Douglas Corp., St. Louis, MO, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1549-52 (1983).
The problem of calculating the total molecular flow conductance of ductwork made up of series connections of elements of known conductance is discussed from the transmission probability point of view. Cases in which there is a discontinuity in cross section between adjacent elements are included. Two criteria for evaluating methods for this calculation are discussed and applied to two such methods. One method, which includes a short procedure for treating discontinuities in duct cross section is shown to satisfy both evaluation criteria. (4 refs.)

118675 Non-isothermal flow of non-linear viscous-ductility liquid in a plane channel with a viscous wall layer. Kh.T.Bektashi.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.1, p.145-8 (1983). In Russian.
Investigates the influence of the viscous heat dependence of the plastic viscosity and ultimate stress of the shift from the temperature on the hydraulic characteristics of the laminar regime of the motion in a plane channel nonlinear viscous ductility medium with a viscous wall layer. (6 refs.)

118676 Extrudate swell for a round jet with large surface tension. H.A.Tieu, D.D.Joseph (Dept. of Aerospace Engng. & Mech., Univ. of Minnesota, Minneapolis, MN, USA).
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.2, p.203-22 (Sept. 1983).
The problem of extrudate swell of a viscoelastic fluid from a round pipe is studied by the method of domain perturbations. The perturbation problems are solved by a finite-element method through second-order in the flow rate parameter ϵ for small flow rates. The analysis extends the work of Sturges (1981) on swelling in two-dimensional channels to round capillary tubes. In perturbation studies for small ϵ, the rheology of the fluid may be expressed by three parameters, the viscosity and the two constants α_1 and α_2 appearing at order two in the expansion of the extra stress around zero shear. Surface tension has an important influence on the shape of the jet at low speeds. The shape of the surface on a round jet depends on α_1 and α_2, in the plane jet only on α_1. The analysis predicts that no matter what the constitutive equation may be, the jet will first contract if the radius of the pipe is sufficiently small. The contraction takes place in a length less than 1/10 the diameter of the jet and is followed by a swell. The contraction is usually small and may be hard to observe. There are five different contributions to the jet shape at second-order but only the viscoelastic ones persist as the pipe radius goes to zero. (14 refs.)

118677 Experiments on a crossflow heat exchanger with tubes of lenticular shape. E.K.Ruth (California Inst. of Technol., Pasadena, CA, USA).
Trans. ASME. J. Heat Transfer (USA), vol.105, no.3, p.571-5 (Aug. 1983).
Measurements of pressure losses and heat transfer rates were made for an unconventional crossflow heat exchanger with tubes of lenticular cross section so spaced to reduce variation in the velocity of the fluid outside the tubes, thus reducing separation and drag. The results of these experiments are reported for various tube spacing and demonstrate that the performance of the lenticular tube heat exchanger is superior to that of conventional circular tubes by 20 percent at Reynolds numbers of 20000 to 50000. (10 refs.)

118678 Unified approach to the solution of problems of unsteady laminar flow in long pipes. M.F.Letelier S (Dept. de Ingenieria Mecanica, Univ. de Santiago de Chile, Santiago, Chile), H.J.Leutheusser.
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.1, p.8-12 (March 1983). [received: Oct. 1983]
Presents a unified approach to the solution of laminar pipe-flow transients in which the forcing function may depend on the motion itself. The key to the solution procedure is a power series expansion of the local velocity in terms of radial position, involving a single time-dependent coefficient. The method of analysis is applied to the solution of two particular cases of transients, namely flow establishment, with and without inflow, respectively. It is found to yield results that are in excellent agreement with other known analytical solutions and experimental observations. (8 refs.)

118679 A numerical investigation for curved pipe flow at high Reynolds number. M.Holt (Dept. of Mech. Engng., Univ. of California, Berkeley, CA, USA), W.-S.Yeung.
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.2, p.239-43 (June 1983).
A numerical scheme for solving the curved pipe flow at high Reynolds number is presented in considerable detail. An efficient scheme based on the conventional Telenin method is developed to solve the general three-dimensional Laplace equation subject to Dirichlet, Neumann, or mixed boundary conditions. (7 refs.)

118680 On transverse secondary flows in wave channels. R.E.Johnson (Dept. of Theoretical & Appl. Mech., Univ. of Illinois, Urbana, IL, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.2, p.244-50 (June 1983).
The viscous boundary layer analysis for the sidewalls of a wave tank is presented for the case of two-dimensional waves of small amplitude traveling along the channel length. The second-order transverse streaming motion induced in the interior of the channel by the sidewall layers is determined. The calculations extend the work of Mei and Liu (1972) which examined the effect of sidewalls on the longitudinal streaming motion. The intensity of the transverse streaming flow is found to increase as the depth to wavelength ratio decreases, and is found to be significant for typical wave tanks that generally have a depth to width ratio between one-half and one-fourth. The present results are useful if accurate conclusions concerning mass transport in the open ocean are to be made from laboratory studies. Furthermore, the results may offer an explanation for some of the laboratory observations already in the literature. (15 refs.)

118681 Flow inside a pneumatic tire: a peristaltic-pumping analysis for the thin-tire limit at very low forward speed. W.J.Rae (Aerodynamic Res. Dept., Calspan Corp., Buffalo, NY, USA).
Trans. ASME. J. Appl. Mech. (USA), vol.50, no.2, p.255-8 (June 1983).
The flow inside a pneumatic tire is analyzed in the limit where the cross-sectional diameter of the tire is small in comparison to the wheel diameter, and where the forward speed is sufficiently low that centrifugal pressure gradients can be neglected. The movement of the contact point around the circumference of the tire produces an internal flow by a mechanism analogous to peristaltic pumping in long flexible ducts. Analytic expressions for the flow velocities and pressures predicted by this model are derived, and are related to tire velocity and load. (4 refs.)

118682 Three dimensional model of turbulent exchange using pulsation energy balance equation. N.I.Buleev, G.A.Zinina.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.36-46 (1983). In Russian.
The authors use the turbulent energy balance equation instead of the Prandtl-Karman generalization of three-dimensional fluid flows. This approach allows calculation of the hydrodynamic and thermal starting sections of channels. Half-empirical constants of the balance equation have been refined by numerical solution for the motion and heat influx equations for steady-state turbulent fluid flows in a circular tube. (14 refs.)

118683 Pulsative fluid flow caused by a PD meter. T.Kawase (Waseda Univ., Tokyo, Japan), T.Machiyama.
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.873-83
Pulsating fluid flow caused by a roots flowmeter, and its nonsteady rotor motion are investigated both analytically and experimentally. The dynamic interaction between the rotor motion and the fluid wave along the pipe line is predicted using the proposed model, the effects of the piping configurations upon the dynamic interaction are quantitatively estimated, and explicit expressions to estimate dynamic quantities such as pressure, flow rate and the angular velocity of the rotor are presented. These estimated results were fairly well confirmed by experiments. A simple and practical method to reduce such fluid pulsation is proposed and its effectiveness is examined using the field test data. (2 refs.)

Heat and mass transfer in a disperse nonequilibrium chemically reacting two-phase flow in a vertical channel .... See Entry 117635

Critical heat flux for uniformly heated vertical channels with low ratios of heated length to heated equivalent diameter .... See Entry 118365

Buckling, postbuckling, and the flow through a tethered elastic cylinder under external pressure .... See Entry 118458

An interferometric investigation of separated forced convection in laminar flow past cavities .... See Entry 118552

Maldistributed inlet flow effects on turbulent heat transfer and pressure drop in a flat rectangular duct .... See Entry 118576

Numerical prediction of wall temperatures for near-critical para-hydrogen in turbulent upflow inside vertical tubes .... See Entry 118577

Numerical solution of natural convection in eccentric annuli . See Entry 118584

Fluid flow and heat transfer in corrugated wall channels. III. Effects of bending angles in the case where channels are bent two times ...... See Entry 118585

Convection driven by concentration- and temperature-dependent surface tension .... See Entry 118587

An experimental study of free convective heat transfer in a parallelogrammic enclosure .... See Entry 118589

Natural convection heat transfer between bodies and their spherical enclosure . ... See Entry 118590

Free convection in a vertical annulus with constant heat flux on the inner wall .... See Entry 118592

Heat transfer in porous media heated from above with evaporation, condensation, and capillary effects .... See Entry 118596

Combined free and forced convection of water between horizontal concentric cylinders .... See Entry 118597

Heat transfer of power law fluid at low Peclet number flow .... See Entry 118598

Natural convection experiments in a triangular enclosure ...... See Entry 118600

Transient and steady-state natural convection in a porous medium between two concentric cylinders .... See Entry 118603

Flows and pressure recovery in a rotating diffuser. Effects of inlet velocity distributions .... See Entry 118606

Flow between rotating disks. II. Stability .... See Entry 118611

Superpotential solution for jet-engine external potential and internal rotational flow interaction .... See Entry 118617

Rarefied gas flow in a cylindrical annulus .... See Entry 118640

Perturbation theory for viscoelastic fluids between eccentric rotating cylinders .... See Entry 118647

The creeping motion of immiscible drops through a converging/diverging tube .. .. See Entry 118650

Prediction of the transit time of a stably stratified flow in a channel with inclined surface .... See Entry 118657

Two-dimensional behaviour of MHD fully developed turbulence ($Rm \gg 1$) .... See Entry 118684

Flow characteristics in the curved rectangular channels. Visualization of secondary flow .... See Entry 118689

Three-dimensional flow development in MHD generators at part load .... See Entry 118771

47.65 MAGNETOHYDRODYNAMICS AND ELECTROHYDRODYNAMICS

(for MHD in plasma, see 52.30)

118684 Two-dimensional behaviour of MHD fully developed turbulence ($Rm \gg 1$). J.Sommeria (Inst. de Mecanique, Univ. de Grenoble, Grenoble, France).
J. Mec. Theor. & Appl. (France), spec, suppl., p.169-90 (1983).
Deals with the two-dimensional properties of liquid metal channel flows under the influence of a strong uniform steady transverse magnetic field. After a short account of the theoretical background, experimental results on the subject are reviewed, emphasizing grid turbulence. Then, a new experimental study is set out, showing the relatively slow decay of the turbulent energy in

a strong magnetic field, and a spectral evolution in $t^{-2} k^{-3}$. These spectra are partly indicative of an enstrophy cascade, the dynamics of the smaller scales being three-dimensional and involving a strong Joule dissipation. Finally, measurements of turbulent heat diffusion along two perpendicular directions illustrates the two-dimensionality of the large eddies and allow interesting comparisons with theories of pairs dispersion in two-dimensional homogeneous turbulence. (20 refs.)

118685 The dynamics of two-dimensional ideal MHD. U.Frisch, A.Pouquet, P.-L.Sulem (CNRS, Obs. de Nice, Nice, France), M.Meneguzzi.
J. Mec. Theor. & Appl. (France), spec, suppl., p.191-216 (1983).
Magnetohydrodynamic (MHD) flow that have high Reynolds number and high magnetic Reynolds number can display violent small-scale phenomena near magnetic neutral points: formation of current sheets, subsequently leading to reconnection processes, tearing mode instabilities, particle accelerations by strong electric fields, etc. In order to understand the earliest stages of current sheet formation the authors have performed a number of numerical experiments with ideal (nondissipative incompressible) two dimensional MHD flows. The authors used periodic boundary conditions and spatial resolutions up to 512^2. For the initial conditions of ORSZAG and TANG (1979) and other flows having neutral points of the X-type, the authors found that vorticity and current grow exponentially in time. The small-scale activity that develops near neutral points is concentrated in quasione dimensional sheet-like structures: as a consequence, nonlinear interactions are strongly inhibited. This geometric feature of the flow is not captured by closure calculations which for ideal 2-D MHD predict blow-up of r.m.s. vorticity and current at a finite time (Pouquet 1978). In the absence of neutral points, the evidence is that Alfven waves prevent the development of motions of arbitrary small scales. (45 refs.)

118686 Stability of convection rolls in the presence of a horizontal magnetic field. F.H.Busse, R.M.Clever.
J. Mec. Theor. & Appl. (France), vol.2, no.4, p.495-502 (1983).
Convection rolls in a horizontal layer of an electrically conducting fluid heated from below are aligned with the direction of the horizontal component of a homogeneous magnetic field intersecting the layer as long as the Rayleigh number is close to its critical value. The authors investigate the influence of a purely horizontal magnetic field on the onset of three-dimensional instabilities in the limit of high magnetic diffusivity and low viscosity. It is found that the Lorentz force exerts a stabilizing influence on the onset of the oscillatory instability and that the region of stable roll solutions is enlarged considerably. Some nonlinear aspects of three-dimensional finite amplitude convection are considered and it is shown that a mean flow is likely to be generated in the presence of an inclined magnetic field. (11 refs.)

Simple waves in quasilinear hyperbolic systems. II. Riemann invariants for the problem of simple wave interactions .... See Entry 117001

Introduction to two-dimensional turbulence .... See Entry 118562

Electrohydrodynamic behavior in twisted-wedge nematic structures .... See Entry 118873

Elastic deformations and electrohydrodynamic instabilities in large pitch cholesteric liquid crystals under an electric field .... See Entry 119083

47.70 REACTIVE, RADIATIVE, OR NONEQUILIBRIUM FLOWS

Heat and mass transfer in a disperse nonequilibrium chemically reacting two-phase flow in a vertical channel .... See Entry 117635

Computation of reacting flowfield with radiation interaction in chemical lasers .... See Entry 118133

On the steady state performance of cocurrent bubble column slurry reactors .... See Entry 118658

Nonequilibrium radiative heating of an ablating Jovian entry probe .... See Entry 121496

Study of charged-particle dynamics during ejection of a reactive jet under orbital flight conditions .... See Entry 121502

47.80 INSTRUMENTATION FOR FLUID DYNAMICS

118687 Design of supercritical cascades with high solidity. J.Sanz (Univs. Space Res. Assoc., Columbia, MD, USA).
AIAA J. (USA), vol.21, no.9, p.1289-93 (Sept. 1983).
The method of complex characteristics of Garabedian and Korn (1977) has been used successfully to design shockless cascades with solidities of up to one. A new code has been developed using this method and a new hodograph transformation of the flow onto an ellipse. This new code allows the design of cascades with solidities of up to two and larger turning angles. The equations of potential flow are solved in a complex hodograph-like domain by setting a characteristic initial-value problem and integrating along suitable paths. The topology that the new mapping introduces permits a simpler construction of these paths of integration. (6 refs.)

118688 Heavy gas mixtures for wind tunnel use. S.K.J.Al-ani, E.A.Johnson (Dept. of Phys., Univ. of Surrey, Guildford, England).
Aeronaut. J. (GB), vol.87, no.866, p.237-40 (June-July 1983).
The advantages of using heavy gases in wind tunnels are reduced power consumption and scale size. To be sure of correct scaling of the results from such a tunnel, the working fluid should have a specific-heat-ratio γ equal to that of air ($\gamma=1.4$); such a fluid can be obtained as a mixture of a monatomic gas with a polyatomic one. General principles for choosing such a mixture are discussed, and estimates are given for the savings in size and scale which may be expected compared to a conventional tunnel. (5 refs.)

118689 Flow characteristics in the curved rectangular channels. Visualization of secondary flow. S.Sugiyama, T.Hayashi (Dept. of Mech. Engng., Osaka Inst. of Technol., Osaka, Japan), K.Yamazaki.
Bull. JSME (Japan), vol.26, no.216, p.964-9 (June 1983).
In order to clarify the secondary flow pattern which appears in curved rectangular channels, flow visualization is made in a fully developed laminar flow. The channels have aspect ratios ranging from 0.5 to 2.5, curvature ratios ranging from 5 to 8 and width of 20 mm. From the experimental results the developing process of secondary flow vortices becomes clear. At a retarded layer near the outer concave wall, additional counter rotating pairs of vortices are observed. The critical Dean number takes the minimum and maximum values at the aspect ratios of about 1 and 2, respectively. The critical Dean number increases rapidly with decreasing aspect ratio when it is smaller than 1. (9 refs.)

118690 The flow around an oscillating sphere. II. The measurement of unsteady drag. T.Urakawa (Dept. of Mech. Engng., Chiba Inst. of Technol., Chiba, Japan), K.Takahashi.
Bull. JSME (Japan), vol.26, no.216, p.978-85 (June 1983).
For pt.I see Trans. Jpn. Soc. Mech. Engng., vol.47, no.413, p.23 (1981). Deals with the measurement of the unsteady drag on an oscillating sphere in a uniform flow. Two dynamic load transducers with high sensitivity were made for measuring the unsteady drag. These devices were proved to be useful by measuring the steady drag and the inertial force of the moving part. The time lapse of the drag and the dependence of its amplitude on parameters are shown in the case where the oscillating motion of the sphere strongly affects the flow. Furthermore, the effects of inertia and viscosity on the unsteady drag are discussed. (9 refs.)

118691 The use of coloured smoke to visualize secondary flows in a turbine-blade cascade. C.H.Sieverding (Von Karman Inst. for Fluid Dynamics, Rhode Saint Genese, Belgium), P.Van den Bosche.
J. Fluid Mech. (GB), vol.134, p.85-9 (Sept. 1983).
A coloured-smoke-visualization technique has been developed for the investigation of complex three-dimensional fluid flows. In particular, a coloured-smoke wire technique is used for the study of secondary flows in straight turbine cascades. Based on a large number of photographs and direct flow observation, the evolution of horseshoe and passage vortices through a high-turning turbine-blade passage is described. (2 refs.)

118692 Interfacing digitized Disa anemometer output to an Apple II computer. J.A.Hardcastle, R.Shaw, M.Shigemi (Mech. Engng. Dept., Univ. of Liverpool, Liverpool, England).
Microprocess. & Microsyst. (GB), vol.7, no.7, p.314-19 (Sept. 1983).
Digitized data from a hot-wire anemometer can be used by an Apple II to calculate the properties of a fluid system. The authors describe the interface and software control. (2 refs.)

118693 A small orifice flowmeter. K.Shiba, T.Ichinose, T.Yamaguchi (Faculty of Engng., Toyoto Univ., Saitama, Japan).
Oyo Buturi (Japan), vol.52, no.6, p.537-43 (June 1983). In Japanese.
The small orifice flowmeter here reported is designed to measure small flowrates. The diameters of trial orifices are 5.0 mm, 2.5 mm, 1.5 mm respectively. The upstream side of the orifice hole is rounded. The tap of downstream side is made in the orifice plate itself. The experimental results for water and spindle oil show that the trial orifice flowmeters are capable of measurement of small flowrates less than 0.5 cm^3/s. Such an orifice flowmeter has several advantages which are excellent interchangeability, good machinability and constant flow coefficient independent of Reynolds number, for a wide range of flowrates. (2 refs.)

118694 Evaluation of the usefulness of a mathematical model of a thermal flow meter for designing purposes. E.Dyakowska, M.Turkowski (Politech. Warszawkiej, Warsaw, Poland).
Pomiary Autom. Kontrola (Poland), vol.29, no.4, p.111-13 (April 1983). In Polish. [received: Sept. 1983]
The authors present a simplified mathematics model of a thermal flow meter. A comparison has been made of characteristics of two types of such flow meters, calculated on the basis of the theoretical model, with those of the prototypes constructed. A conformity has been obtained sufficient for designing purposes between the theoretical and experimental results for a flow meter of constant power rating. An analysis is also made of influence of the simplifications assumed on a discrepancy between theory and practice. (4 refs.)

118695 An ultraconic flowmeter—wave meter UMP-10. K.Kolodziej, R.Wawrzyniak (Zaklad Doswiadczalny Stechpan, Warsaw, Poland), S.Walus.
Pomiary Autom. Kontrola (Poland), vol.29, no.6, p.181-3 (June 1983). In Polish.
Operation principle and design features of an ultrasonic flowmeter-water meter built in the 'Techpan' plant, Warsaw are described. Test results confirming the predicted measurement accuracy for a real value of the velocity distribution correction factor are presented. (9 refs.)

118696 Wind tunnel flow quality and data accuracy requirements. F.Steinle, E.Stanewsky.
Report AGARD-AR-184, AGARD, Neuilly sur Seine, France (Nov. 1982), iii+26 pp.
This report is written by the Wind Tunnel Testing Techniques (TES) Subcommittee of the AGARD Fluid Dynamics Panel. It deals with flow quality and data accuracy requirements for wind tunnel testing. The emphasis is on transonic test conditions. Two conveners, one from each side of the Atlantic, were appointed by the TES Subcommittee. The conveners brought together the foremost workers for purposes of discussing the current level of testing technology, what are the requirements of the future, and what needs to be done. It was found in more than a few situations, the requirements for data accuracy and flow quality are not well defined. The requirements that are compiled represent the current thinking. To aid in understanding the impact of flow quality and data accuracy, included in this study is a detailed examination of their contributions to the test results of a transport-type configuration. The approach can be adapted to other types. The results of this effort correlate well with what is generally accepted. (33 refs.)

118697 A digitized telemetric system for transient phenomenon measurement [underwater explosion]. Qian Qiaonian (Inst. of Mech., Acad. Sinica, Peking, China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.63-72
An analysis is made of the features of the signals generated by the gauge in an underwater explosion, requirements for measuring the explosion and problems associated with oscilloscope-photograph recordings. A new digitized telemetric system for measuring underwater explosive pressure is introduced. Typical data acquired in actual explosions are given. (4 refs.)

118698 Vortex flowmeter: concept and application. D.K.Lyle (Fisher Controls Internat. Inc., Marshalltown, IA, USA).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.473-82
The basic principle of vortex generation, reviews the relative advantages of the vortex meter over the traditional technique of differential pressure measurement and provides a general scope for vortex meter applications in process control. (5 refs.)

118699 A magnetic flowmeter with conducting pipe wall. H.Yamasaki, S.Honda, T.J.Chin (Univ. of Tokyo, Tokyo, Japan), C.Akiyama.
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.785-92
The internal pipe wall of magnetic flowmeters should be nonconductive to prevent generation of electromotive force from short circuiting. This is usually

achieved by lining the metallic pipe with insulating material. The lining material limits applicable temperature range of the measured fluid and also reliability of the meter. the objectives of this investigation are to eliminate the lining and to improve reliability and performance of the magnetic flowmeter. A potential distribution is formed over the pipe wall by applying electric current proportional to the fluid flowrate. The potential distribution over the wall is kept almost identical to the flow induced potential in the liquid so that no current flows across the boundary between fluid and wall. Therefore the output signal is exactly the same as that of conventional magnetic flowmeters. Theoretical analysis and experimental results are described. (5 refs.)

Separated flow flutter of two dimensional triangular cylinder subjected to uniform flow from base. I. Preliminary experimental studies with flow visualizations by water tank and wake survey with small wind tunnel .... See Entry 118604

Flow between rotating disks. I. Basic flow .... See Entry 118610

Metering of gas-liquid two-phase flow by sharp-edged orifices and the effect of fluid compressibility on experimental results .... See Entry 118666

Pulsative fluid flow caused by a PD meter .... See Entry 118683

Laser speckle technique for the visualization of retinal blood flow .... See Entry 120849

A microscope-television system for online measurement of blood flow velocity in microvessel using an adaptive window .... See Entry 120983

47.90 OTHER TOPICS IN FLUID DYNAMICS

118700 Decay of electromagnetic waves in fluids. G.M.Kremer (Dept. of Phys., Univ. Federal do Parana, Curitiba, Brazil), I.-S.Liu.
J. Non-Equilibrium Thermodyn. (Germany), vol.8, no.1, p.67-73 (1983).
It is known that several types of electromagnetic waves can propagate in fluids. In this work, with singular surface analysis, the behaviors of such waves propagating parallel and perpendicular to the external field are examined. In both cases, it is shown that the waves always decay provided that the electric conductivity and susceptibility are positive. (4 refs.)

Grain flow as a fluid-mechanical phenomenon .... See Entry 118549

50.00 FLUIDS, PLASMAS AND ELECTRIC DISCHARGES

(for fluid dynamics, see 47.; for the physics of condensed matter, see 60. and 70.)

51.00 KINETIC AND TRANSPORT THEORY OF FLUIDS; PHYSICAL PROPERTIES OF GASES

51.10 KINETIC AND TRANSPORT THEORY

118701 On the gas-gas equilibria of polar-non-polar binary mixtures from a polarizable hard-sphere dipole model. O.H.Scalise, A.E.Rodriguez, F.Vericat (Inst. de Fisica de Liquidos y Sistemas Biologicos, La Plata, Argentina).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.378-82 (16 Sept. 1983).
Perturbation theory is applied to a polarizable hard-sphere dipole model mixture. It is shown that for increasing values of the reduced polarizability of the non-polar component, gas-gas equilibria of the first and second kind can be described for a polar-non-polar binary mixture. However, for the latter case, critical lines do not show the minimum in temperature observed in real systems. Comparison between theoretical and experimental results are given for He-NH_3 and Ar-H_2O mixtures. (25 refs.)

118702 H-theorem and Onsager principle in the stationary Boltzmann equation. A.M.Bishaev, V.A.Rykov.
Zh. Vychisl. Mat. & Mat. Fiz. (USSR), vol.23, no.4, p.954-64 (July-Aug. 1983). In Russian. English translation in: *USSR Comput. Math. & Math. Phys. (GB)*
Using a kinetic approach an expression is obtained for the production of entropy in the case of a problem of surface flow. In a linear approximation it is shown that thermodynamic forces are components of the incoming flow and differences of temperature between body and gas at infinity. Components of resistive force and heat flux appear as flows. On the basis of the linear Boltzmann equation and boundary conditions which satisfy a reciprocity condition, symmetry of kinetic coefficients in the flows is shown (Onsager principle). (9 refs.) *A.G.C.*

Second-order approximations for the transport properties of dilute polyatomic gases .... See Entry 118703

51.30 THERMAL PROPERTIES OF GASES

118703 Second-order approximations for the transport properties of dilute polyatomic gases. G.C.Maitland, M.Mustafa, W.A.Wakeham (Dept. of Chem. Engng. & Chem. Technol., Imperial Coll., London, England).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1425-41 (Sept. 1983).
Explicit expressions for the bulk viscosity, thermal conductivity and shear viscosity of a dilute polyatomic gas are derived. The results are correct to a second-order approximation within the framework of the semi-classical Wang Chang and Uhlenbeck kinetic theory (1964). The effective cross-sections which determine the transport coefficients have been reduced to threefold collision integrals over the inelastic differential scattering cross-section for binary molecular encounters. (19 refs.)

A line-by-line calculation of low-resolution radiative properties of CO_2-CO-transparent nonisothermal gases mixtures up to 3000K .... See Entry 118359

Heavy gas mixtures for wind tunnel use .... See Entry 118688

51.50 ELECTRICAL PHENOMENA IN GASES

(see also 52. Plasma and electric discharges)

118704 Calculation of electron swarm parameters in fluorine. M.Hayashi, T.Nimura (Nagoya Inst. of Technol., Nagoya, Japan).
J. Appl. Phys. (USA), vol.54, no.9, p.4879-82 (Sept. 1983).
Swarm parameters of electrons have been calculated for fluorine by a Monte Carlo simulation and the Boltzmann equation method for the first time. Values of these parameters have been obtained for ratios of the electric field to the gas number density E/N from 100 to 3000 Td (E/p_0=35-1000 V/cm Torr). Available experimental and theoretical cross sections were used for the calculations. (18 refs.)

118705 Laue distribution of large values of time delay of electrical breakdown in nitrogen. M.M.Pejovic (Faculty of Electronic Engng., Univ. of Nis, Nis, Yugoslavia), B.J.Mijovic, Dj.A.Bosan.
J. Phys. D (GB), vol.16, no.10, p.1953-7 (14 Oct. 1983).
This paper gives the Laue distribution of time delay of electrical breakdown (t_d) for five pressure values of nitrogen in gas-filled diodes. Distributions were obtained for 20% overvoltage, and passive time (τ) 5 s and 7.2×10^3 s. The breakdown in nitrogen is induced by long-lived metastable states formed in the previous gas ionisation. The results show that the Laue distributions also hold for such groups of data when t_d varies between a fraction of a second and several hundreds of seconds. (15 refs.)

Time evolution of ion swarm transport in a constant mean free time encounter region .... See Entry 117960

Competition between stimulated Brillouin scattering and optical breakdown in argon .... See Entry 118218

Wall material and wall temperature effects on negative ion production in a hydrogen plasma .... See Entry 118732

Interaction of a laser pulse with a target. II. Photoionization of the ambient medium .... See Entry 118741

51.60 MAGNETIC PHENOMENA IN GASES

(for liquids, see 75.)

118706 Linearization of the magneto-optic signals produced by the Voigt effect in atomic vapors. R.Stephens (Dept. of Chem., Dalhousie Univ., Halifax, Canada).
Spectrochim. Acta Part B (GB), vol.38B, no.8, p.1077-86 (1983).
General formulae are derived to describe the formation of linear magneto-optic signals. The formulae allow the efficiency of any optical linearisation element to be determined once the Jones matrix of the device is known. The introduction of background optical transmission is an unwanted but unavoidable result of any linearization process which employs passive optical components. Under suitable conditions it is found that a rotated variable retardation plate approximates to an ideal linearizing element for either dichroic or birefringent signals. Theoretical results are compared with experimental measurements on the Na 589.0 nm line. (20 refs.)

Coherent polarization methods of nonlinear spectroscopy of a gas in a longitudinal magnetic field .... See Entry 118708

51.70 OPTICAL PHENOMENA IN GASES

(for liquids, see 78.)

118707 Dispersion relations and sum rules in the Faraday effect. M.T.Thomaz (Phys. Dept., Univ. of Wisconsin, Madison, WI, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3057-63 (15 Sept. 1983).
Dispersion relations and sum rules are obtained for a gaseous insulating medium, under the influence of a weak constant external magnetic field. The application of the causality principle to the constitutive equation of the medium together with the behavior of free electrons in the high-frequency limit give the analytic behavior of the optical constants in the upper half complex plane, new dispersion relations, and new sum rules. The fact that the average refractive index, as well as the difference of the complex refractive indices of right and left circularly polarized waves, satisfies dispersion relations is justified by the application of relativistic causality. (11 refs.)

118708 Coherent polarization methods of nonlinear spectroscopy of a gas in a longitudinal magnetic field. V.P.Mishchenko (Inst. of Radiophys. & Electronics, Acad. of Sci., Ukrainian SSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.542-53 (July 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.761-72 (July 1982). [received: Sept. 1983]
New polarization methods are proposed for the independent determination of the three relaxation constants of the gaseous transition $J=0 \rightarrow J=1$ with a large Doppler broadening. The methods consist of recording the polarization signal of a test field at the parametric frequency with saturating and weak (auxiliary) fields present, along with the use of coherent four-photon processes in a degenerate transition in a magnetic field. It is shown how it is necessary to select the polarizations, initial phases, frequency detunings and field intensities, as well as the amount of Zeeman splitting, in order to observe in the spectrum of the parametric radiation nonlinear resonances spaced in frequency or magnetic field which contain information about the three constants. The possibilities of the magnetoscopic and spectroscopic methods for determining the characteristics are analyzed. (17 refs.)

Electronic absorption spectrum of 2-amino-4-methyl pyrimidine in vapour phase .... See Entry 117884

Competition between stimulated Brillouin scattering and optical breakdown in argon .... See Entry 118218

Linearization of the magneto-optic signals produced by the Voigt effect in atomic vapors .... See Entry 118706

Investigation of the absorption of radiation emitted from a tunable CO_2 laser by water vapor in the range 9-11 μ .... See Entry 121372

52.00 THE PHYSICS OF PLASMAS AND ELECTRIC DISCHARGES

(for solid-state plasma, see 72.30)

52.20 ELEMENTARY PROCESSES IN PLASMA

52.20F Electron collisions

Implicit moment PIC-hybrid simulation of collisional plasma .... See Entry 118748

52.20H Atomic, molecular, heavy-particle collisions

Measurement of total decay rates of excited states in a deuterium plasma by laser-resonance fluorescence .... See Entry 118756

Isotope separation in a low-pressure DC discharge .... See Entry 118790

52.25 PLASMA BASIC PROPERTIES

Stochastic aspects in the theory of spectral-line broadening. II. Noncommutative cluster expansions .... See Entry 117083

Stark broadening of the Paschen-beta line of hydrogen in a linear discharge .... See Entry 117830

A heat transfer study for a partially immersed refractory rod in a plasma .... See Entry 118709

A study of the VUV emission from highly ionized krypton in a theta pinch plasma .... See Entry 118711

Gain in the 100-1000 Å range in a homogeneous stationary plasma .... See Entry 118713

Wall material and wall temperature effects on negative ion production in a hydrogen plasma .... See Entry 118732

The laser irradiated gas jet: A spectroscopic experimental and theoretical study .... See Entry 118737

Ionization and expansion of a multiply charged laser plasma .... See Entry 118739

Mass spectra and ionization temperatures in an argon-nitrogen inductively coupled plasma .... See Entry 118749

Application of Thomson scattering to the diagnosis of plasma temperatures within the Joint European Torus using 10.6 μm radiation ..... See Entry 118752

Whistler-mode electron cyclotron emission as an electron temperature diagnostic for magnetic mirror devices .... See Entry 118761

Measurement of electron concentrations by hydrogen line-broadening using a photodiode array spectrometer .... See Entry 118764

Study of the discharge cleaning process in JIPP T-II torus by residual gas analyzer .... See Entry 118768

Optical and spectroscopic investigations of a pulsed near-surface discharge at atmospheric pressure .... See Entry 118782

Analysis of radial distribution of plasma parameters in a coaxial-line microwave discharge tube .... See Entry 118783

Measurements of energetic electrons in a magnetized hot filament discharge .... See Entry 118784

Use of electric probes in silane radio frequency discharges ... See Entry 118785

Calculation of the electric arc characteristics in a cylindrical channel taking into account radiation based on the three-layer model .... See Entry 118791

Excitation of acoustic gravity waves by sources moving in the atmosphere at an angle with the horizon .... See Entry 121422

52.25F Transport properties

118709 A heat transfer study for a partially immersed refractory rod in a plasma. P.Meubus, A.Charette (Dept. of Appl. Sci., Univ. du Quebec, Quebec, Canada).
Chem. Eng. Sci. (GB), vol.38, no.10, p.1741-6 (1983).
The thermal behavior of a tungsten rod partially immersed in a plasma flame is analyzed. The longitudinal temperature profiles are obtained by numerical solution of the heat balance equation. A heat transfer model consisting of pure natural convection up to the plasma outer edge and forced convection inside the plasma, fails to predict temperatures at the hot tip of the rod. In order to make the experimental and calculated profiles to converge, one has to consider modifications in the mechanical and thermal conditions of the surrounding medium due to the presence of the rod in the plasma. This leads to the use, in the 'cold' gas zone, of particular values of heat transfer coefficient h and of a parameter T_x which is defined only at the immediate boundary of the rod. The latter are given in the form of variations along the axis of the rod. This perturbation effect decreases with the rod diameter. Allowance is made for the variation of the thermal properties of the solid. (16 refs.)

On the bifurcation and nonuniqueness of MHD-equilibrium and Tokamak transport .... See Entry 118717

Drift wave transport and origin of the disruption phenomenon - A theoretical model .... See Entry 118727

Interaction of a laser pulse with a target. I. Photoelectron mechanism of generation of a spontaneous magnetic field .... See Entry 118740

A model magnetic field for the calculation of particle-drift motions in a toroidal stellarator .... See Entry 118745

Implicit moment PIC-hybrid simulation of collisional plasma .... See Entry 118748

Quantitative evaluation of the parameters and the deviation of an electric current in a magnetic field .... See Entry 118775

Magnetically confined low-pressure gas discharge generated in a vacuum switch .... See Entry 118780

Properties of a series crossed-field discharge in a vacuum switch .... See Entry 118781

52.25P Emission, absorption, and scattering of radiation

118710 Observations of odd-half cyclotron harmonic emissions in a shell-Maxwellian laboratory plasma. J.M.Urrutia, R.L.Stenzel (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.7086-94 (1 Sept. 1983).
Loss cone distributions have, until recently, been considered the prime cause of odd-half cyclotron harmonic emissions. On the basis of new observations, it has been proposed that shell-Maxwellian distributions are also unstable to these modes. To test this model, the authors have designed a laboratory experiment where a shell-Maxwellian distribution is produced. Analysis of the plasma noise spectrum shows that the emissions fall within the cyclotron harmonic branches (Bernstein waves). Test wave dispersion analysis, spectral correlation measurements, and real time observations indicate that the authors plasma, which has the upper hybrid resonance in the first Bernstein wave branch ($\omega_{uh}/\omega_{ce}=1.8$), exhibits a nonconvective (absolute) instability at $\omega/\omega_{ce}=1.3$, in contrast to the predictions of loss cone theory for the upper hybrid branch. In addition, the test wave dispersion relation of the plasma reveals that below the instability frequency the system behaves as if it were composed of shell electrons only. Present theories do not account for these findings. (27 refs.)

118711 A study of the VUV emission from highly ionized krypton in a theta pinch plasma. L.A.Jones (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA), E.Kallne.
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.4, p.317-26 (Oct. 1983).
The ionization rates of Kr(IX), (X), (XI), and (XII) have been measured using a fast 60 kV-60 kJ theta pinch as a plasma source. The line emission from each ion stage has been identified and the time evolution observed. A coupled set of rate equations was used along with time- and space-resolved measurements of the electron density and temperature to model the plasma light emission. The ionization rates of Kunze (1977) were adjusted by multiplying the rate for each ion stage with a constant until the peak intensity of the calculated emission agreed with the time of the observed peak intensity. The constants required for best fit were 2.5, 0.15, 3.0, and 2.0 for Kr(IX), (X), (XI), and (XII), respectively. Two successive ionization stages, Kr(X) and Kr(XI), have shown the same time dependence and possible reasons for this observation are discussed. During the course of modeling the light emission, the authors also found that the rate for the excitation from the $3d^n$ to the $3p^5 3d^{n+1}$ level in Kr(X) ($n=9$) and Kr(XI) (n=8) is a factor of 5 lower than predicted by the van Regemorter excitation rate equation. (24 refs.)

118712 Electron cyclotron emission and absorption in fusion plasmas. M.Bornatici (Facolta di Ingegneria, Univ. di Pavia, Pavia, Italy), R.Cano, O.De Barbiere, F.Engelmann.
Nucl. Fusion (Austria), vol.23, no.9, p.1153-1257 (Sept. 1983).
The state of the art in the field of electron cyclotron emission and absorption of fusion plasmas confined by a magnetic field is reviewed. The general theory is described concisely, explicit results being given mainly for plasmas in local thermodynamic equilibrium. Moreover, the practical implications of these effects with respect to cyclotron radiation losses, the use of cyclotron emission as a diagnostic tool, and electron cyclotron heating and current drive are discussed with emphasis on tokamak plasmas. (263 refs.)

118713 Gain in the 100-1000 Å range in a homogeneous stationary plasma. A.V.Vinogradov, V.N.Shlyaptsev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.303-6 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.516-22 (March 1983). [received: Oct. 1983]
Calculations are made of the gain in a multiply charged homogeneous stationary plasma due to transitions in neon-like ions in the 100-1000 Å wavelength range. the range of electron temperatures and densities for which the maximum gain is observed in the selected element is determined. (11 refs.)

52.30 PLASMA FLOW; MAGNETOHYDRODYNAMICS

(see also 47.65 Fluid dynamics)

118714 Dispersion of a plasma cluster over a less dense plasma background. Yu.A.Berezin, P.V.Khenkin.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.764-8 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR)*, vol.23, no.6, p.37-40 (Nov.-Dec. 1982). [received: Sept. 1983]
The influence of finite conductivity (Coulomb and anomalous) on cluster motion and magnetic field growth is investigated. The problem of expansion of a plasma cylinder into a rarefied plasma is modeled numerically. The model of two-fluid hydrodynamics which is simpler than the hybrid model is used. (10 refs.)

118715 Free-boundary MHD stability of pressureless oblate spheromaks—dependence on aspect ratio and elongation. C.Pfersich, R.Gruber, F.Troyon (Centre de Recherches en Phys. dcs Plasmas, Ecole Polytech. Federale de Lausanne, Lausanne, Switzerland).
Nucl. Fusion (Austria), vol.23, no.9, p.1127-34 (Sept. 1983).
Ignoring the stability effect of a conducting shell or conductors, it is found that an oblateness parameter $\epsilon=-0.3$ and an aspect ratio closest to one give optimal stability properties for a spheromak. In the pressureless case, only the n=1 tilting and, possibly, the n=2 kink modes are unstable. If these two modes are actively stabilized, appreciable beta values of a few per cent can be obtained, the limiting modes being Mercier modes with very small growth rates. (14 refs.)

118716 Application of the parallel chords method to solving implicit difference magnetohydrodynamic equations. V.A.Gasilov, T.K.Korshiya, B.Ya.Lyubimov, V.F.Tishkin, A.P.Favorskii, M.Yu.Shashkov.
Zh. Vychisl. Mat. & Mat. Fiz. (USSR), vol.23, no.4, p.936-46 (July-Aug. 1983). In Russian. English translation in: *USSR Comput. Math. & Math. Phys. (GB)*
A system of implicit difference magnetohydrodynamic equations is examined in a two-dimensional formulation. Linearization of the source equations is carried out in such a way that it leads to a system of linear equations of relatively increased coordinates of nodes of the difference network. The matrix of the system of linear equations is symmetrical and non-negative definite, which makes it possible to use effective methods for its treatment. An example of a numerical solution of a model problem is presented, dealing with the compression of a finite mass of ideally conducting plasma in a magnetic field. (14 refs.) *A.G.C.*

118717 On the bifurcation and nonuniqueness of MHD-equilibrium and Tokamak transport. G.Paris, A.Ag, A.Montvai, G.Neméth (Central Res. Inst. for Phys., Budapest, Hungary).
In *Collection of scientific papers in collaboration with joint Institute for Nuclear Research, Dubna, USSR and Central Research Institute for Physics, Budapest, Hungary. Algorithms and programs for solution of some problems in physics. Vol.IV*, p.109-25. Report KFKI-1983-21, Hungarian Acad. Sci., Budapest (1983), 191 pp.
Nonlinear MHD-equilibrium equation is investigated. By the help of the Ritz-method in a simplified form calculations are given for the Astron and for the nonlinear heat-transport problems. (4 refs.)

Ionization and expansion of a multiply charged laser plasma .... See Entry 118739

Dissipative effects on stable RFP configuration .... See Entry 118747

52.35 WAVES, OSCILLATIONS, AND INSTABILITIES IN PLASMA

118718 Excitation of the electron plasma waves in a magnetized plasma by a slow waveguiding circuit. T.Idehara (Dept. of Appl. Phys., Fukui Univ., Fukui, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1176-81 (July 1983).
The excitation of the electron plasma wave in a magnetized plasma (the Trivelpiece-Gould wave) is studied experimentally, using a slow waveguiding circuit surrounding the plasma column. The wave vector of the excited wave can be controlled externally. In the case of weak inhomogeneity, the group velocity v_g of the excited wave makes a right-angle with the phase velocity v_{ph}. In the lower branch of the wave $(\omega<\omega_c)$, the wave propagates as a forward wave in the axial direction and as a backward wave in the radial direction. In the upper branch $(\omega>\omega_c)$, it propagates as a backward wave in the axial direction and as a forward wave in the radial direction. (13 refs.)

118719 Direct measurement of fast magnetosonic wave near the ion-ion hybrid resonance layer by magnetic probes. K.Ida, M.Naito, S.Shinohara, K.Miyamoto (Dept. of Phys., Faculty of Sci., Univ. of Tokyo, Tokyo, Japan).
Nucl. Fusion (Austria), vol.23, no.9, p.1259-62 (Sept. 1983).
Direct measurement of the fast magnetosonic wave near the hybrid resonance layer in a deuterium-hydrogen plasma by magnetic probes is described. Externally driven waves in the ion cyclotron range of frequencies (ICRF) are excited by a half-turned antenna located on the high-field side in the TNT-A tokamak. The amplitude and the phase shift of the fast magnetosonic wave are measured by magnetic probes in the equatorial plane of the plasma. The amplitude of the fast magnetosonic wave is damped in the ion-ion hybrid resonance layer, and the wavelength changes at the high-field side near this layer. The amplitude and the phase shift of the wave as measured by the probes agree with those calculated from a cold-slab model. (14 refs.)

118720 The electron-acoustic-drift instability. A.S.Sharma, M.Mohan (Phys. Res. Lab., Ahmedabad, India), M.Y.Yu.
Phys. Lett. A (Netherlands), vol.97A, no.9, p.387-90 (26 Sept. 1983).
In an inhomogeneous plasma in a magnetic field, if the ions are much hotter than the electrons, the electron-acoustic mode couples to the drift mode and this coupling results in the electron-acoustic-drift instability. (8 refs.)

118721 Experimental study of a toroidal plasma under the conditions for adiabatic Budker-Buneman instability. A.Hirose, J.D.Paulson, H.M.Skarsgard, S.Wolfe (Dept. of Phys., Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1179-82 (26 Sept. 1983).
Conditions suitable for the adiabatic electron-ion-two-stream instability have been created in a toroidal plasma. Observed anomalous resistivity, turbulent heating rates, and ion plasma oscillations are in favorable agreement with the recent theoretical predictions. (15 refs.)

118722 Magnetic surface waves in plasmas. R.D.Jones (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1269-71 (3 Oct. 1983).
The existence of a new type of surface wave in plasmas is demonstrated. These waves are intimately connected with the self-generation of magnetic fields in the laser-plasma interaction. The waves resemble waveguide modes in that a number of discrete modes can exist. The modes are localized to within a collisionless skin depth of the surface and, in the collisionless fluid limit, there is no restriction on the distance the waves can propagate. (13 refs.)

118723 Interaction of magnetosonic solitons with quasipotential waves [plasma waves]. E.M.Gromov (Inst. of Appl. Phys., Acad. of Sci., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.519-23 (July 1982).
Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.734-8 (July 1982).
[received: Sept. 1983]
The interaction of fast magnetosonic solitons with upper- and lower-hybrid, quasipotential waves propagating across an external magnetic field is discussed. The evolution of the spectrum of the high-frequency waves in the given field of the soliton is determined in the approximation of geometrical optics, when the wavelength of the high-frequency waves is much less than the characteristic length of the soliton. The possibility of the reflection of high-frequency wave packets from a soliton when there is positive wave dispersion $(\partial^2\omega/\partial k^2>0)$ and of capture when it is negative $(\partial^2\omega/\partial k^2<0)$ is demonstrated. The peculiarities of the transformation of the spectrum of high-frequency waves when an inflection point is present in the dispersion characteristic curve of these waves are investigated. The variation of the soliton's parameters is found in the approximation of conservation of its shape by the soliton in the presence of high-frequency waves. (8 refs.)

118724 Stochastic stabilization of the explosive instability in a nonequilibrium plasma. S.Ya.Vyshkind, E.A.Dubinina, S.L.Sakovskaya, S.M.Fainshtein (Gorki Polytech. Inst., Gorki, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.554-9 (July 1982).
Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.773-8 (July 1982).
[received: Sept. 1983]
The explosive instability of longitudinal waves in a beam-plasma system is examined. It is found that under certain conditions in the system indicated, stochastic stabilization of the 'explosion' is possible, and in this case complex attracting regions with random characteristics are formed in phase space. Estimates for laboratory plasma are presented. (13 refs.)

118725 Parametric and combination wave plasma processes in the low-hybrid electron frequency region excited by high-frequency electric pumping field. II. S.A.Aliev, G.S.Kirichenko.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1354-61 (Sept. 1983). In Russian.
For pt.I see ibid., vol.28, p.1173 (1983). Combination wave plasma processes in the oblique Langmuir oscillation region were investigated experimentally. Primary waves were excited parametrically by HF pumping and by an electron beam independently. Chaotic ionic frequency phase breakings of nonlinear HF oscillations were found. (14 refs.)

118726 Soliton generation in inhomogeneous plasma by a running wave field. V.A.Brazhnik, V.I.Grishaev, V.V.Demchenko, Yu.A.Zhdanov, P.I.Kravtsov.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1361-4 (Sept. 1983). In Russian.
The process of nonlinear saturation of absolute parametric instabilities excited in an inhomogeneous plasma by a running wave field was investigated in hydrodynamic approximation. The numerical analysis showed that the mechanism in the instability saturation was universal both in a strong wave coupling regime and in a weak one. It is of strong turbulent nature based on the soliton generation process under the action of the unstable wave electric field ponderomotive force. (1 ref.)

118727 Drift wave transport and origin of the disruption phenomenon - A theoretical model. G.Hasselberg, A.Rogister.
Report JUL-1830, Kernforschungsanlage, Julich, Germany (Feb. 1983), 48 pp.
Nonlinear ion Landau damping of drift waves yields a splitting of the spectrum into a long and a short wavelength branch. The latter contributes most (>90%) of the transport and permits to explain the observed relaxation of Tokamak plasma profiles to a weakly unstable state, in the occurrence with regard to the dissipative trapped electron mode. The fluxes indeed increase much more rapidly than the linear growth rates. This result and surprising coincidences between the linear theory and empirical laws concerning the high density limit lead the authors to propose that the slow rise of the sawtooth pulsations of the core occurs whilst the transport in the surrounding layer is insufficient to evacuate the power deposited. The sudden relaxation takes place once the released heat pulses are capable—much as in collisionless shock waves—of exciting the trapped electron mode to a sufficient level to ensure adequate transport. (57 refs.)

Observations of odd-half cyclotron harmonic emissions in a shell-Maxwellian laboratory plasma .... See Entry 118710

Exact *k*-spectrum for the KdV equation: Application to drift wave turbulence .... See Entry 118728

Radiation from a bounded plasma due to scattering of unstable plasma waves off ion-sound oscillations .... See Entry 118731

Interaction of waves and boundary surface moving in collisionless plasma .... See Entry 118734

Magnetically confined low-pressure gas discharge generated in a vacuum switch .... See Entry 118780

Properties of a series crossed-field discharge in a vacuum switch .... See Entry 118781

Propagation of high frequency waves in strongly magnetized plasmas. Mode ambiguities due to vacuum polarization .... See Entry 121519

52.35R Plasma turbulence

118728 Exact *k*-spectrum for the KdV equation: Application to drift wave turbulence. H.Tasso, K.Lerbinger (Max-Planck-Inst. fur Plasmaphys., Garching, Germany).
Phys. Lett. A (Netherlands), vol.97A, no.9, p.384-6 (26 Sept. 1983).
The *k*-spectrum of Korteweg-de Vries turbulence is computed exactly. It consists of a superposition of lorentzians in *k*. It is determined by both the steepening and the dispersive term. Application to drift waves in a Tokamak shows quatitative agreement with measurements. (4 refs.)

Stochastic stabilization of the explosive instability in a nonequilibrium plasma .... See Entry 118724

Soliton generation in inhomogeneous plasma by a running wave field .... See Entry 118726

52.40 PLASMA INTERACTIONS

52.40D Electromagnetic wave propagation in plasma

118729 Electromagnetic wave propagation at high frequency in a plasma LMG [waveguide]. M.A.G.Calderon, J.L.Garcia, A.Vegas (Facultad de Ciencias, Santander, Spain).
An. Fis. Ser. B (Spain), vol.79, no.2, p.90-7 (May-Aug. 1983). In Spanish.
[received: Oct. 1983]
This paper deals with the theoretical study of EM waves propagation in a plasma LMG. (14 refs.)

118730 Second-harmonic emission from laser-plasma interactions. Xu Zhizhan, Xu Yuguang, Yin Guangyu, Zhang Yanzhen, Yu Jiajin, P.H.Y.Lee (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
J. Appl. Phys. (USA), vol.54, no.9, p.4902-8 (Sept. 1983).
The authors have systematically investigated the second-harmonic (2ω) emission spectrum from 1.06-μm laser-plasma interactions. Experimental data on the dependence of 2ω spectrum, especially its broadness and complexity, on laser irradiation intensity, incidence angle, and prepulse are presented. A theoretical model using linear mode conversion and parametric decay instability processes can qualitatively explain the experimental results. (13 refs.)

Two-dimensional simulation of a plasma KrF pulse compressor .... See Entry 118174

Magnetic surface waves in plasmas .... See Entry 118722

Propagation of high frequency waves in strongly magnetized plasmas. Mode ambiguities due to vacuum polarization .... See Entry 121519

52.40F Antennas in plasma; plasma-filled wave guides

118731 Radiation from a bounded plasma due to scattering of unstable plasma waves off ion-sound oscillations. V.A.Balakirev.
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.528-31 (July 1982).
Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.745-9 (July 1982).
[received: Sept. 1983]
Studies the excitation of radiation due to scattering of a plasma wave off an ion sound wave in a plasma waveguide. (The plasma wave growth is due to the kinetic beam instability.) The author has shown that radiation energy losses may stabilize the instability. The author has found conditions in which practically all of the plasma wave energy is transformed into radiation. (11 refs.)

Excitation of the electron plasma waves in a magnetized plasma by a slow waveguiding circuit .... See Entry 118718

Magnetic surface waves in plasmas .... See Entry 118722

52.40H Solid-plasma interactions

118732 Wall material and wall temperature effects on negative ion production in a hydrogen plasma. W.G.Graham (Phys. Dept., New Univ. of Ulster, Coleraine, N Ireland).
J. Phys. D (GB), vol.16, no.10, p.1907-15 (14 Oct. 1983).
The effect of wall material and wall temperature on negative ion production in a hydrogen plasma has been studied. Under the same plasma conditions, within the combined uncertainties of the measurements, the same negative ion densities were found for Pyrex, stainless steel, copper and molybdenum. However, there seems to be a trend for stainless steel walls to produce somewhat higher negative ion densities. Contamination of the walls with hydrocarbons was found to reduce the negative ion density. It was also found that cooling the Pyrex walls leads to an increase in the negative ion density. (10 refs.)

118733 The one component plasma near a hard wall—weak coupling limit with image forces. A.Alastuey (Lab. de Phys. Theorique et Hautes Energies, Univ. de Paris-Sud, Orsay, France).
Mol. Phys. (GB), vol.50, no.1, p.33-48 (Sept. 1983).
The author computes the one and two body distribution functions of both two and three dimensional one component plasmas near a flat dielectric hard wall, in the weak coupling limit. In two dimensions, he uses a well known scheme in which all the electrostatic forces are treated perturbatively. In three dimensions, the image forces can no longer be treated perturbatively and the author derives a new formalism appropriate to this case. (16 refs.)

118734 Interaction of waves and boundary surface moving in collisionless plasma. A.D.Kanareikin, V.N.Krasil'nikov (Leningrad State Univ., Leningrad, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.523-8 (July 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.739-44 (July 1982). [received: Sept. 1983]
Reflection of plane waves by a reticular mirror in a collisionless plasma is analyzed, the motion of this mirror being described by a single function so that supergroup velocities can be considered and the trend of changes in the frequency of the reflected field can be explained. An expression is derived for the dispersive diffusion of wavefronts within the transition region. (4 refs.)

118735 On hydrogen recycling and gas desorption in a glow discharge. S.F.Grishin, V.Ya.Chernyshenko, V.B.Yuferov.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1365-70 (Sept. 1983). In Russian.
Deals with glow discharge cleaning of a stainless steel vacuum chamber. The irradiation dose increased, the time for a 100% hydrogen recycling decreases and the efficient factor of hydrogen implantation rises. With $D>3\times10^{18}$ ion/cm^2, the discharge is sustained practically in pure hydrogen. (6 refs.)

A heat transfer study for a partially immersed refractory rod in a plasma .... See Entry 118709

Measurement of the recombination rate coefficient of a tokamak vacuum vessel wall .... See Entry 118743

A system for in situ studies of plasma-surface interactions using X-ray photoelectron spectroscopy .... See Entry 118754

Study of the discharge cleaning process in JIPP T-II torus by residual gas analyzer .... See Entry 118768

Quantitative evaluation of the parameters and the deviation of an electric current in a magnetic field .... See Entry 118775

52.40K Sheaths

Monte-Carlo simulation of electron properties in RF parallel plate capacitively coupled discharges .... See Entry 118789

52.40M Beam interactions in plasma

Stochastic stabilization of the explosive instability in a nonequilibrium plasma .... See Entry 118724

Parametric and combination wave plasma processes in the low-hybrid electron frequency region excited by high-frequency electric pumping field. II .... See Entry 118725

52.50 PLASMA PRODUCTION AND HEATING

118736 Stationary mode of expansion of a vapor heated by radiation or a fast-particle flux. A.V.Dobkin, T.B.Malyavina, I.V.Nemchinov.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.743-50 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR)*, vol.23, no.6, p.14-22 (Nov.-Dec. 1982). [received: Sept. 1983]
High-power radiation or fast-particle flux will evaporate the surface of an obstacle and will heat the vapor to high temperatures, the vapor then expanding with high velocity. The authors examine the stationary corona for the case where the bombardment is by ions or radiation fluxes and the energy transfer near a sphere occurs under conditions close to those of radiative thermal conduction. (31 refs.)

Time decay of electric fields probed by charged reaction products in six-beam symmetrical implosion experiments .... See Entry 117698

Experimental study of a toroidal plasma under the conditions for adiabatic Budker-Buneman instability .... See Entry 118721

Observation of effects of inhomogeneous magnetic field on resonance cone fields .... See Entry 118753

Measurements of energetic electrons in a magnetized hot filament discharge .... See Entry 118784

52.50J Plasma production and heating by laser beams

118737 The laser irradiated gas jet: A spectroscopic experimental and theoretical study. R.W.Lee, D.L.Matthews, L.Koppel (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA), G.E.Busch, G.Charatis, M.J.Dunning, F.J.Mayer.
J. Appl. Phys. (USA), vol.54, no.9, p.4909-15 (Sept. 1983).
The authors present X-ray spectroscopic measurements of the longitudinal electron density profile and the longitudinal and transverse electron temperature profiles for a laser irradiated gas jet. They attempt to verify their spectroscopic method by laser interferometry and by comparison of inferred quantities to those determined from laser plasma interaction simulations. Because temperature profiles were time dependent, they used a theoretical time dependent radiation transport code to analyze the data. (9 refs.)

118738 Enhanced spatial and spectral resolution in laser plasma spectroscopy using band-shaped implants on plane targets. J.-C.Gauthier, J.-P.Geindre, K.Najmabadi (Univ. Paris-XI, Orsay, France), C.Popovics, A.Poquerusse, M.Weinfeld.
J. Phys. D (GB), vol.16, no.10, p.1929-41 (14 Oct. 1983).
Band-shaped aluminium implants on plane carbon targets were irradiated at $0.1\text{-}2\times10^{15}$ W cm^{-2} by 600 ps laser pulses of 0.527 μm wavelength. The resulting blow-off plasmas were diagnosed by X-ray spectroscopy using entrance slits of various dimensions, orientations and positions with respect to the target plane. The authors studied the longitudinal and radial variations of line intensities and Stark widths of He-like and H-like Rydberg series. The effect of time integration was also qualitatively studied by varying implant thickness. Results showed a tenfold decrease of instrumental broadening due to the small lateral expansion of the plasma eliminating radial spatial deconvolution and minimising opacity effects. Comparison with computer modelling showed that $n\geq4$ Al^{12+} Lyman series emissions peaked in a 20 μm width region close to the target and that electron densities deduced from Stark broadening agree well with the simulations. (17 refs.)

118739 Ionization and expansion of a multiply charged laser plasma. A.v.Vinogradov, V.N.Shlyaptsev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.298-302 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.509-16 (March 1983). [received: Oct. 1983]
An analysis is made of the hydrodynamics and ionization of matter in the process of interaction of laser radiation with targets made of heavy elements. An approximate method is developed to allow for the effects of ionization and a study is made of the influence of ionization on the hydrodynamic parameters of a plasma. Distributions of the electron density and temperature, and of the charge composition of a laser plasma are obtained. (30 refs.)

118740 Interaction of a laser pulse with a target. I. Photoelectron mechanism of generation of a spontaneous magnetic field. O.B.Anan'in, Yu.A.Bykovskii, B.V.Zamyshlyaev, I.K.Novikov, E.L.Stupitskii (Engng. Phys. Inst., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.307-14 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.523-34 (March 1983). [received: Oct. 1983]
An experimental and theoretical study is reported of a spontaneous magnetic field which appears as a result of interaction of laser radiation with a target. The attention is concentrated on the early component of the field which appears simultaneously with the laser pulse and persists until a laser plasma arrives at the point of measurement. A theoretical analysis is made of the mechanism of the appearance of this early component of a spontaneous magnetic field because of the formation of a current system in which the source is in the form of fast photoelectrons generated by photoionization of the background media by the radiation emitted from a laser plasma. This theoretical model is used to calculate the intensity of a spontaneous magnetic field in a wide range of pressures of the background medium and laser radiation powers. The experimental results obtained using an external magnetic field indicate the existence of an internal source of the current responsible for the appearance of the early component of a spontaneous magnetic field and confirm the proposed theoretical model. (55 refs.)

118741 Interaction of a laser pulse with a target. II. Photoionization of the ambient medium. E.L.Stupitskii (Engng. Phys. Inst., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.315-18 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.534-40 (March 1983). [received: Oct. 1983]
For pt.I see ibid., vol.13, no.3, p.307-14 (1983). An investigation is made of the ionization of air by X-rays emitted from a high-temperature region of the interaction between a laser pulse and a target. The role of the various ionization mechanisms is determined and it is found that at a distance of several centimeters from the target the degree of ionization of air reaches its maximum value when the pressure in the chamber is $\sim$0.1 Torr and the laser radiation intensity is $\sim10^{13}$ W/cm^2. (10 refs.)

118742 Laser driven shock wave studies in single and double-layered slab targets. S.Eliezer, L.Gitter, A.D.Krumbein, D.Salzmann.
Report IA-1378, Israel Atomic Energy Comm., Tel Aviv (Jan. 1983), 46 pp.
Laser Driven Shock Wave Studies in Single and Double-layered Slab Targets. Simulations of laser-driven shock waves were carried out by means of a 1-D Lagrangian hydrodynamic code for pure and layered polyethylene and aluminum slab targets. Scaling laws were obtained for the pressure and temperature which are in good agreement with those found in the literature. High compressions were found to occur at the interface of CH_2 on Al targets but not when the layers were reversed. Long persistence times, relative to the plasma characteristic times, were found for this high pressure and the pressure could be optimized by adjusting the CH_2 layer thickness. (28 refs.)

Soft X-ray imaging microscopy using zone plates and nonsynchrotron sources .... See Entry 117297

Preheating energy in a soft-X-ray-accelerated foil .... See Entry 117696

Spectral quality of He-Zn II and He-Cd II hollow cathode metal vapor lasers in the magnetic fields .... See Entry 118188

Stationary mode of expansion of a vapor heated by radiation or a fast-particle flux .... See Entry 118736

Electrical discharge channel in sodium vapor initiated by resonant laser light .... See Entry 118779

52.50L Plasma production and heating by shock wave and wire explosion

Laser driven shock wave studies in single and double-layered slab targets .... See Entry 118742

52.55 PLASMA EQUILIBRIUM AND CONFINEMENT

118743 Measurement of the recombination rate coefficient of a tokamak vacuum vessel wall. H.Howe, R.Langley (Fusion Energy Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1435-40 (1983).
The recombination rate coefficient of the ISX-B vacuum vessel wall has been measured by observing the rate of decrease of gas pressure in the vessel during a glow discharge. A simple analytic expression which relates the rate of change of the pressure to the recombination rate is derived and verified by comparison with a complete numerical simulation. Comparison of the recombination coefficient measured in ISX-B with previous laboratory measure-

ments shows that the measured value is typical for a stainless steel surface covered with an oxide layer. (17 refs.)

118744 Equilibria of field-reversed configuration with subsidiary coils. M.Kako, T.Ishimura (Plasma Phys. Lab., Osaka Univ., Suita, Osaka, Japan), T.Amano.
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3056-65 (Sept. 1983).
Two-dimensional equilibria of a field-reversed configuration with subsidiary coils are computed by integrating the ideal magnetohydrodynamic equilibrium equation. The mirror coils have an effect to compress the plasma appreciably in the axial direction and hence sustain the compact torus. The cusp coils enlarge the plasma and consequently make the gradient of plasma density relaxed in the radial direction. (13 refs.)

118745 A model magnetic field for the calculation of particle-drift motions in a toroidal stellarator. W.N.G.Hitchon, K.D.McLenithan, H.E.Mynick (Torsatron/Stellarator Lab., Dept. of Electrical & Computer Engng., Univ. of Wisconsin, Madison, WI, USA).
Nucl. Fusion (Austria), vol.23, no.9, p.1143-52 (Sept. 1983).
A model for the magnetic field strength along a stellarator field line has been developed which correctly describes the principal contributions to the field strength and which can differ substantially from the simple form commonly assumed. An analytically tractable form of the model is obtained and is compared with results from ray-tracing in real fields. A theoretical description of the drift motions of 'localized' particles (trapped in the helical ripples on the magnetic field) is then obtained for a more general class of stellarator field than previously possible. Orbits in real devices are considered for both $l=2$ and $l=3$, and differences between the predictions of the present work and of earlier investigations are pointed out. The application of the theory to particle guiding-centre orbit following is discussed, and other consequences of the improved model field are indicated. (12 refs.)

118746 The engineering of magnetic fusion reactors. R.W.Conn.
Sci. Am. (USA), vol.249, no.4, p.44-55 (Oct. 1983).
Design projects under way and experimental reactors now being built will test the practicality of schemes for generating power from the thermonuclear fusion of ions trapped by magnetic fields. (no refs.)

118747 Dissipative effects on stable RFP configuration. N.Nakajima, Y.Nomura, H.Momota.
Report IPPJ-631, Nagoya Univ., Japan (April 1983), 30 pp.
Evolutions of RFP equilibria due to dissipative effects are studied theoretically. It is shown that the existence of stable RFP equilibria satisfying ideal and nonideal MHD stability criteria requires adequate hollow temperature profiles. If no profile control is applied to these RFP equilibria, the sufficient condition of stability for $m=1$ modes is first violated due to the disappearance of the toroidal current reversal near the surface within a short time. (8 refs.)

A study of the VUV emission from highly ionized krypton in a theta pinch plasma .... See Entry 118711

Electron cyclotron emission and absorption in fusion plasmas .... See Entry 118712

Free-boundary MHD stability of pressureless oblate spheromaks—dependence on aspect ratio and elongation .... See Entry 118715

On the bifurcation and nonuniqueness of MHD-equilibrium and Tokamak transport .... See Entry 118717

Experimental study of a toroidal plasma under the conditions for adiabatic Budker-Buneman instability .... See Entry 118721

Drift wave transport and origin of the disruption phenomenon - A theoretical model .... See Entry 118727

Nonlinear plasma spectroscopy of the hydrogen Balmer-α line .... See Entry 118750

Application of Thomson scattering to the diagnosis of plasma temperatures within the Joint European Torus using 10.6 μm radiation .... See Entry 118752

A rapid-frequency-scan laser for measurement of velocity distribution of impurities in plasmas by fluorescence spectroscopy .... See Entry 118758

Whistler-mode electron cyclotron emission as an electron temperature diagnostic for magnetic mirror devices .... See Entry 118761

Study of the discharge cleaning process in JIPP T-II torus by residual gas analyzer .... See Entry 118768

Magnetically confined low-pressure gas discharge generated in a vacuum switch .... See Entry 118780

Properties of a series crossed-field discharge in a vacuum switch .... See Entry 118781

52.65 PLASMA SIMULATION

118748 Implicit moment PIC-hybrid simulation of collisional plasma. R.J.Mason (Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Comput. Phys. (USA), vol.51, no.3, p.484-501 (Sept. 1983).
A self-consistent scheme was developed to model electron transport in evolving plasmas of arbitrary classical collisionality. The electrons and ions are treated as either multiple Eulerian fluids or collisional particles-in-cell. Particle suprathermal electrons scatter off ions, and drag against fluid background thermal electrons. The background electrons undergo ion friction, thermal coupling, and bremsstrahlung. The components accelerate in electric fields obtained by the implicit moment method, which permits $\Delta t \gg \omega_p^{-1}$ and $\Delta x \gg \lambda_D$—allowing the treatment of problems 10^2-10^3 times more complex than those accessible with older explicit methods. The fluid description for the background plasma components permits the modeling of transport in systems spanning more than a 10^7-fold change in density, and encompassing contiguous collisional and collisionless regions. Results are presented from application of the scheme to the modeling of CO_2 laser-generated suprathermal electron transport in expanding thin foils, and in multi-foil target configurations. (19 refs.)

Time decay of electric fields probed by charged reaction products in six-beam symmetrical implosion experiments .... See Entry 117698

Two-dimensional simulation of a plasma KrF pulse compressor .... See Entry 118174

The laser irradiated gas jet: A spectroscopic experimental and theoretical study .... See Entry 118737

Monte-Carlo simulation of electron properties in RF parallel plate capacitively coupled discharges .... See Entry 118789

52.70 PLASMA DIAGNOSTIC TECHNIQUES AND INSTRUMENTATION

118749 Mass spectra and ionization temperatures in an argon-nitrogen inductively coupled plasma. R.S.Houk, A.Montaser, V.A.Fassel (Ames Lab., Iowa State Univ., Ames, IA, USA).
Appl. Spectrosc. (USA), vol.37, no.5, p.425-8 (Sept.-Oct. 1983).
Positive ions were extracted from the axial channel of an inductively coupled plasma (ICP) in which the outer gas flow was Ar, N_2, or a mixture of Ar and N_2. Addition of N_2 to the outer gas decreases the electron number density (n_e) in the axial channel. Ar^{+2}, O_2^+, and ArH^+ react with N-containing species in the plasma and/or during the ion extraction process. Ar^+ remains abundant even if there is no Ar in the outer gas, which indicates the probable occurrence of charge transfer reactions between N_2^+ and Ar. The present work corroborates two general concepts upon which several theories of the origin of suprathermal ionization in ICPs are based: (a) species are physically transported from the induction region to the axial channel; and (b) these species may react with and ionize neutral species in the axial channel. Ionization temperatures (T_{ion}) measured from the ratio Cd^+/I^+ were 5750 to 6700K for a N_2 outer flow ICP at a forward power of 1.2 kW. This T_{ion} range is significantly below that obtained for an Ar outer gas ICP under otherwise similar operating parameters. (39 refs.)

118750 Nonlinear plasma spectroscopy of the hydrogen Balmer-α line. E.W.Weber, R.Frankenberger, M.Schilling (Phys. Inst., Univ. Heidelberg, Heidelberg, Germany).
Appl. Phys. B (Germany), vol.B32, no.2, p.63-73 (Oct. 1983).
The plasma line broadening of H_α fine-structure lines is investigated with Doppler-free saturation and polarization spectroscopy in He-H gas and arc discharges at plasma densities of 10^8 cm^{-3} $<N\lesssim 1.4\times10^{14}$ cm^{-3}. With a single-mode laser, the shift and broadening of four resolved $H_\alpha$fs lines are measured in a low pressure discharge for $N<10^{11}$ cm^{-3}. With an intense, broadband multi-mode laser the plasma effects of H_α are investigated up to $N=1.4\times10^{14}$ cm^{-3} in a hollow cathode arc. Calculations in the classical phase shift and impact approximations can explain the experimental data and peculiarities of the low-density plasma effects and show that the ions are the dominant perturbers. Ion dynamical effects, perturber mass and temperature dependence are observed and interpreted. Applications of the nonlinear techniques to other H and D lines, other atoms, and for H and D plasma diagnostics are discussed. (23 refs.)

118751 Coding aperture applied to X-ray imaging of laser-plasmas. N.Fleurot, J.P.Gex, R.Sauneuf (CEA/CEL, Villeneuve-Saint-Georges, France), N.de Beaucoudray.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.182-7 (1983). In French. (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
The investigation of phenomena occurring in micro-plasmas created by laser is mainly based on images obtained from emitted X-rays or α-particles. To obtain images, the pinhole camera is widely used but the collection efficiency of radiation or particles as also the signal-to-noise ratio (S/N ratio) decrease as the spatial resolution is increased. To improve the S/N ratio one can use a coding-aperture imaging device, the collecting surface of which is much larger than the pinhole one. The authors have chosen a simple coding-aperture made of a circular slit cut in a thin foil which is opaque at the radiation considered. The slit width is $\delta=6$ μm; the mean radius is $R=1$ mm. The image reconstruction is obtained by numerical processing (Fourier transform and filtering). The transverse spatial resolution δ_t in the object is $\delta_t \simeq \delta$ but can be improved by a factor of 2 or 3 if the edges of the circular slit are sharp. The axial spatial resolution (tomographic effect) δ_l is $\delta_l \simeq \delta_t l_1/R$, with l_1 the code-to-object distance. (9 refs.)

118752 Application of Thomson scattering to the diagnosis of plasma temperatures within the Joint European Torus using 10.6 μm radiation. D.A.Reynolds, I.J.Spalding, T.Stamatakis, A.C.Walker (Culham Lab., UKAEA, Abingdon, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.616-21 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
On completion, the Joint European Torus (JET) will be the largest nuclear fusion experiment constructed. The authors are currently developing a novel system to measure radial electron temperature/density profiles and central ion temperatures within the plasma using 10 Hz rep-rate CO_2 laser. The large dimensions and expected neutron fluxes represent significant constraints on this design. Specifically the input and collected scattered radiation have to be relayed between shielded lasers/detectors and the torus, ~30 m away, and the alignment maintained remotely. This system, containing ~75 mirrors and designed with the aid of a computer ray-tracing program, is described together with some details of the spectrometer and laser. (4 refs.)

118753 Observation of effects of inhomogeneous magnetic field on resonance cone fields. T.Ohnuma (Dept. of Electrical Engng., Tohoku Univ., Sendai, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1226 (July 1983).
In an inhomogeneous (converging) magnetic field in a plasma, resonance cone fields are experimentally found to spread with respect to the curved magnetic field line which passes through the source. (4 refs.)

118754 A system for in situ studies of plasma-surface interactions using X-ray photoelectron spectroscopy. J.L.Vossen, J.H.Thomas,III., J.-S.Maa, O.R.Mesker, G.O.Fowler (RCA Labs., Princeton, NJ, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1452-5 (1983).
A system is described in which plasma/surface treatments can be performed and the substrates can be analyzed by X-ray photoelectron spectroscopy by transferring them via a load lock into the analytic chamber. Also described are some plasma etching experiments that demonstrate the utility of this apparatus. The system emulates larger systems in which plasma treatments are performed at pressures, voltages, and power densities similar to those employed in large commercial systems. (20 refs.)

118755 Spectroscopic measurement of hydrogen contamination in weld arc plasmas. J.E.Shea, C.S.Gardner (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.4928-38 (Sept. 1983).
The introduction of hydrogen into metals during welding is known to cause hydrogen assisted cracking and embrittlement in certain situations. It has been shown that the weld metal hydrogen content is directly related to hydrogen concentration in the weld arc plasma. In this paper the authors describe a simple spectroscopic technique for measuring the arc plasma hydrogen concentration in real time when an argon shield gas is used. This technique is based on the fact that the intensity ratio of the hydrogen Balmer Alpha emission line at 6563 Å and an argon emission line at 6965 Å was observed to be an approximately linear function of hydrogen concentration in the weld arc plasma. This technique was experimentally verified under a

variety of welding conditions for gas metal arc welding and found to have an error of less than 10% when measuring hydrogen concentrations in the arc plasma as low as 0.25% by volume. This method of hydrogen measurement is also applicable when welding with shield gases not containing argon so long as a suitable ratioing line is available. (12 refs.)

118756 Measurement of total decay rates of excited states in a deuterium plasma by laser-resonance fluorescence. G.Himmel, L.Sowa (Inst. fur Experimentalphys. II, Ruhr-Univ. Bochum, Bochum, Germany).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.4, p.357-64 (Oct. 1983).
In a deuterium plasma with an electron density of 2.8×10^{13} cm^{-3} and an electron temperature of 1850K, the $n=2$ level is coupled to the $n=6$ level by absorption of short-pulsed laser light. Due to inelastic and superelastic electron collisions, the enhanced $n=6$ population density is distributed to its neighbouring levels, i.e. $n=5$ and $n=7$. The laser-resonance fluorescences of the Balmer lines D_5, D_6, and D_7 were measured with time resolution. The transient behaviour of the fluorescence is compared with numerical calculations, which are based on the rate equations for population densities of a system with 5 states. It is observed that the rate coefficients of Johnson (1972) cannot explain the authors experimental data. The coefficients of Vriens and Smeets (1980) compare favourably with the measurements within experimental errors. (11 refs.)

118757 A new reimaging technique for measurement of the radial density distribution of metastable states. M.R.Teixeira, F.C.Rodrigues (Servico de Optica e Fisica dos Plasmas, LNETI, Sacavem, Portugal).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.4, p.365-9 (Oct. 1983).
Measurements of absorption and calculations of the radial density distribution of metastable states require the use of an external light source. The authors describe a simple reimaging technique. The theory of the method and its application to the determination of the radial density distribution of metastable states in a hollow cathode are presented. The method requires uniformity along the axis of the discharge, symmetrical reimaging, and knowledge of absorption at the boundary of the plasma. (5 refs.)

118758 A rapid-frequency-scan laser for measurement of velocity distribution of impurities in plasmas by fluorescence spectroscopy. C.Honda (Faculty of Engng., Kyushu Univ., Fukuoka, Japan), K.Nishimura, M.Maeda, K.Muraoka, M.Akazaki.
J. Phys. D (GB), vol.16, no.10, p.1943-52 (14 Oct. 1983).
Laser fluorescence spectroscopy is a useful technique to determine the density and the flux of metallic atom impurities in the edge region of Tokamaks. A new scheme to measure the Doppler profile of impurity atoms by a single laser shot is proposed. The frequency of dye-laser emission is rapidly scanned across the Doppler profile during the laser action in the order of microseconds. A flashlamp-pumped dye laser is tuned by a piezoelectrically scanned etalon, and a scanning range of 60 pm is obtained with a resolution of 3 pm at $\lambda\simeq600$ nm. Fluorescence line profiles of Na atoms are determined with a resolution of less than 1 pm. Several problems of Tokamak measurements are briefly discussed. (18 refs.)

118759 Gain and loss kinetics in a pulsed discharge by scanning in time with a probing laser pulse. V.V.Gruzinskii, V.A.Suchkov.
J. Appl. Spectrosc. (USA), vol.38, no.1, p.102-6 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR),* vol.38, no.1, p.120-6 (Jan. 1983). (13 refs.)

118760 High temperature plasma diagnostics by beam probe spectroscopy. K.Kadota, J.Fujita (Inst. of Plasma Phys., Nagoya Univ., Chikusa-ku, Nagoya, Japan).
J. Spectrosc. Soc. Jpn. (Japan), vol.32, no.4, p.223-40 (1983). In Japanese. (85 refs.)

118761 Whistler-mode electron cyclotron emission as an electron temperature diagnostic for magnetic mirror devices. G.D.Tsakiris, R.F.Ellis (Lab. for Plasma & Fusion Energy Studies, Univ. of Maryland, College Park, MD, USA).
Nucl. Fusion (Austria), vol.23, no.9, p.1115-25 (Sept. 1983).
A non-relativistic formulation has been developed which calculates the whistler-mode electron cyclotron emission spectrum in the direction parallel to the magnetic field for a plasma containing an isotropic Maxwellian electron component and an anisotropic bi-Maxwellian electron component. The formulation is valid for arbitrary densities of both components and the model utilizes the radiation transfer equation to obtain the intensity of the emitted radiation. The calculations are intended for use with mirror devices and the motivation is to use cyclotron emission as an electron temperature diagnostic. The projected plasma parameters for the TMX-Upgrade machine have been considered as an example, where the plasma is assumed to have a cold- and a hot-electron temperature profile can be obtained from spectral measurements of the cyclotron emission. The effect of the hot-electron population has been considered in detail and it is shown that in certain circumstances their influence on the emitted spectrum is small. For those cases where hot electrons dominate the emission, the model can be used to obtain important information about hot-electron behaviour. (7 refs.)

118762 Measurement of ionization rates of Ti IX, Ne VI, Ne VII, and O VI. R.U.Datla, J.R.Roberts (NBS, Washington, DC, USA).
Phys. Rev. A (USA), vol.28, no.4, p.2201-8 (Oct. 1983).
The effective ionization rates of Ti IX, Ne VI, Ne VII, and O VI have been measured with the use of the plasma spectroscopy method in a θ pinch discharge at an electron temperature (50-60 eV) much below their ionization threshold and at an electron density of $(\simeq2\text{-}3)\times10^{16}$ cm^{-3}. A theoretical analysis of the effective ionization rates showed that excitation ionization is a major contributing process. Theoretical values are in reasonable agreement with experiment. (22 refs.)

118763 Optogalvanic double-resonance spectroscopy in a neon discharge. K.Miyazaki, H.Scheingraber, C.R.Vidal (Inst. fur Extraterrestrische Phys., Max-Planck-Inst. fur Phys. & Astrophys., Garching bei Munchen, Germany).
Phys. Rev. A (USA), vol.28, no.4, p.2229-44 (Oct. 1983).
A recently proposed method of optogalvanic double-resonance (OGDR) spectroscopy, which employs two CW lasers modulated at different frequencies and a DC discharge, has been investigated theoretically as well as experimentally. The technique is demonstrated to provide a versatile, state-selective spectroscopic method. A detailed analysis has been carried out for different situations where two lasers pump transitions which have the lower and/or upper state, or no state, in common. It also shows that the OGDR signal detected at the sum or difference modulation frequency can be given as a linear combination of the perturbed population densities in a plasma which give rise to the single-resonance signal. In addition, the results show that the OGDR signal polarity is characteristic for each type of double resonance. This has been verified in an OGDR experiment using a hollow-cathode discharge in neon and two CW dye lasers. State-selective OGDR spectra have been compared with optical-optical double-resonance spectra. Useful applications and advantages of the OGDR spectroscopy are discussed. (48 refs.)

118764 Measurement of electron concentrations by hydrogen line-broadening using a photodiode array spectrometer. R.R.Williams, G.N.Coleman (Dept. of Chem., Univ. of Georgia, Athens, GA, USA).
Spectrochim. Acta Part B (GB), vol.38B, no.8, p.1171-8 (1983).
A novel apparatus for measuring hydrogen line broadening in plasmas using a linear photodiode array spectrometer is described and applied to the measurement of spatially resolved electron concentrations in two- and three-electrode direct current plasmas. The sources and magnitude of the errors associated with those line width measurements are also discussed. (14 refs.)

118765 Investigation of electron spectra of chemi-ionization processes in the afterglow plasma. V.I.Demidov, N.B.Kolokolov, O.G.Toronov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.87-91 (Aug. 1983). In Russian.
The relationship is considered between the velocity distribution function of fast electrons measured in the afterglow plasma and electron spectra of chemi-ionization processes. A method of determining spectra from electron velocity distribution functions measured by Langmuir probes is proposed. (6 refs.)

Time decay of electric fields probed by charged reaction products in six-beam symmetrical implosion experiments .... See Entry 117698

Effect of metastable states on the emission lines of OIII, OIV and OV ions .... See Entry 117818

Stark broadening of the Paschen-beta line of hydrogen in a linear discharge .... See Entry 117830

A study of the VUV emission from highly ionized krypton in a theta pinch plasma .... See Entry 118711

Direct measurement of fast magnetosonic wave near the ion-ion hybrid resonance layer by magnetic probes .... See Entry 118719

The laser irradiated gas jet: A spectroscopic experimental and theoretical study .... See Entry 118737

Enhanced spatial and spectral resolution in laser plasma spectroscopy using band-shaped implants on plane targets .... See Entry 118738

Diagnostics of a plasma jet with grid electrodes .... See Entry 118770

Local dependence of rise time of spectral line intensities in Ne glow discharge tube .... See Entry 118777

Optical and spectroscopic investigations of a pulsed near-surface discharge at atmospheric pressure .... See Entry 118782

Use of electric probes in silane radio frequency discharges ... See Entry 118785

52.75 PLASMA DEVICES AND APPLICATIONS

(see also 28.52 Fusion reactors, 86.30L Electrogasdynamic and magnetohydrodynamic conversion; for ion sources, see 29.25 Particle sources and targets)

118766 Runaway electrons in the small shell-less Tokamak device NOVA-I. E.Nishimura (Energy Res. Lab., Hitachi Ltd., Hitachi-shi, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1182-7 (July 1983).
The mechanisms of the production and confinement of runaway electrons in the Tokamak device NOVA-I were studied by experimentally measuring the energies of these electrons examining how their behavior depended on the discharge parameters. Numerical calculations were also made on their drift orbits. From a comparison of the experimental and numerical analyses, it is concluded that: (1) neutral particles obstruct the production of runaway electrons during the breakdown phase of the discharge, while the densities of electrons having energies of the order of 10 eV build up; (2) electrons then begin to run away in the hot central region of the plasma, since the density of neutral particles decreases with ionization; (3) the orbits of the runaway electrons shift outward while spreading radially as the energy of the runaway electrons increases with time, until the orbits intersect the outer limiter or the torus wall. (12 refs.)

118767 Toroidal plasma device with a helical magnetic axis: Asperator NP-4. Y.Funato, I.Sakamoto, H.Watanabe (Dept. of Nuclear Engng., Tohoku Univ., Sendai, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1188-93 (July 1983).
A new magnetic trap with a three-dimensional magnetic axis is designed and constructed and the results together with the properties of the magnetic field configuration of the system are described. The field configuration of the device is characterized by a non-planar axis with a multi-field period of $n=8$ around the torus, an extremely high rotational transform angle of $\iota/2\pi=5.6$ and good helical symmetry. Engineering problems in the fabrication of the vacuum chamber and the magnetic coil system and the overall construction of the device are discussed. The magnetic field configuration measured by the electron beam method and a magnetic probe agrees well with the result of numerical calculation. (11 refs.)

118768 Study of the discharge cleaning process in JIPP T-II torus by residual gas analyzer. N.Noda, S.Hirokura, Y.Taniguchi, S.Tanahashi (Inst. of Plasma Phys., Nagoya Univ., Nagoya, Japan).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1430-4 (1983).
After several hours of discharge cleaning, it has been observed that the decay time of the water-vapor partial pressure changes from one well defined value to another. A long decay time observed in the later phase can be interpreted as a result of a slow deoxidation rate of chromium oxide, which may dominate the cleaning process in this phase. Optimization of the electron density for the cleaning is discussed, comparing the experimental results on density dependence of the water-vapor partial pressure with a result based on a zero-dimensional calculation for particle balance. One of the essential points for effective cleaning is found to be raising the electron density of the plasma high enough that the dissociation loss rate of H_2O is as large as the sticking loss rate. A density as high as 10^{11} cm^{-3} is required for a clean surface condition where sticking probability is presumed to be around 0.5. (16 refs.)

118769 The design study of high voltage plasma focus for a large fluence neutron source by using a water capacitor bank. I.Ueno (Dept. of Electrical Engng., Univ. of Tokyo, Tokyo, Japan), T.Kobata.
J. Fac. Eng. Univ. Tokyo Ser. B (Japan), vol.37, no.1, p.79-93 (March 1983). [received: Oct. 1983]
A new possibility for a high intensity neutron source (HINS) would be opened by the plasma focus device if one has a high voltage capacitor bank. A scaling law of neutron yield for D-T gas discharge in a plasma focus device is obtained after Imshennik, Filippov and Filippova (1973). The resulting scaling law shows the realizability of the D-T HINS by the use of a plasma focus, provided that the device is operated under a high voltage condition. Until now, it has been difficult to construct a high voltage capacitor bank of long life, for example with $V_0=300$ kV, $C_0=200$ μF and $L_0\sim5$ nH necessary in the level of HINS. It becomes possible to design this capacitor bank by using the coaxial water capacitor which has been developed for the electron

and ion beam accelerator. The size of a capacitor designed for $V_0=300$ kV, $C_0=1$ μF is $\phi 5$ m$\times$22 m. Two hundred capacitors are used in parallel in order to get the 200 μF. (11 refs.)

118770 Diagnostics of a plasma jet with grid electrodes. V.I.Batkin, V.N.Getmanov, O.Ya.Savchenko, R.A.Khusainov.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.758-64 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR),* vol.23, no.6, p.30-6 (Nov.-Dec. 1982). [received: Sept. 1983]
The authors describe the diagnostics of a plasma jet ejected from the anode hole of a pulsed arc hydrogen plasma source. The beam diagnostics system used allows proton and atomic components of the beam to be analysed separately with a large transverse energy resolution. G.V. Roslyakov's (1981) assumption of the free streaming of protons in a plasma jet is confirmed. (11 refs.)

118771 Three-dimensional flow development in MHD generators at part load. E.D.Doss, R.K.Ahluwalia (Argonne Nat. Lab., Argonne, IL, USA).
J. Energy (USA), vol.7, no.4, p.289-90 (July-Aug. 1983).
The three-dimensional behavior of flow in magnetohydrodynamic (MHD) generators at design and off-design loading points is investigated. Faraday as well as diagonally connected channels with insulating or conducting sidewalls are considered. The role of MHD body forces in generating axial vorticity and hence secondary flows in the cross stream has been analyzed. For Faraday channels with strong MHD interaction, the generated vorticity is shown to direct the secondary flow from the cathode to the anode wall along the centerline. For diagonally connected channels near short circuit, the generated vorticity is shown to direct the secondary flow from the anode to the cathode wall along the centerline, and vice versa at near open-circuit conditions. (3 refs.)

118772 Magnetodrodynamic generator scaling analysis for baseload commercial powerplants. D.W.Swallom, C.C.P.Pian (Avco Everett Res. Lab., Everett, MA, USA).
J. Energy (USA), vol.7, no.4, p.338-44 (July-Aug. 1983).
Magnetohydrodynamic generator channel scaling analyses have been performed to establish the effect of generator size and oxygen enrichment on channel performance. These studies have shown that MHD generator channels can be designed to operate efficiently over the range of 250-2135 MW. The optimum design conditions for each of the thermal inputs were established by investigating various combinations of electrical load parameters, pressure ratios, magnetic field profiles, and channel lengths. From these parameter variations the set of conditions producing the optimum performance was selected for the design point. These results provide design flexibility for the baseload combined cycle MHD/steam powerplant. (17 refs.)

118773 Simulation of starting transients in the UTSI MHD generator. Y.F.Liao, M.Ishikawa, H.J.Schmidt, Y.C.L.Wu (Univ. of Tennessee Space Inst., Tullahoma, TN, USA).
J. Energy (USA), vol.7, no.4, p.374-81 (July-Aug. 1983).
A numerical procedure for solving the unsteady, two-dimensional, compressible Navier-Stokes equations has been extended for magnetohydrodynamic (MHD) flows by the inclusion of the appropriate Lorentz force and Joule heating terms in the governing equations. With appropriate initial and boundary conditions, the procedure can be used for the investigation of transient phenomena as well as the asymptotic steady-state characteristics of internal MHD flows. Results obtained for the simulation of starting processes in the UTSI coal-fired MHD flowtrain are presented and found to be in good agreement with experimental observations. (13 refs.)

52.80 ELECTRIC DISCHARGES

(see also 51.50 Electrical phenomena in gases)

118774 Sparkover time lag of gap having a protrusion in anode. N.Ikuta (Tokushima Univ., Tokushima, Japan), K.Kondo, K.Yoshida, Y.Ishiguro.
Trans. Inst. Electr. Eng. Jpn. Sect. E (Japan), vol.103, no.3-4, p.23-32 (March-April 1983).
Using a special gap providing a needle protrusion in the anode, values of time lag τ from the start of UV irradiation to sparkover under DC voltages are measured. The distribution of log τ for the applied voltage shows a slim and linear pattern over about 10% voltage range from the minimum value. The linear region in the log τ-V diagram moves consistently depending on the gas temperature, gas flow and other conditions not electrical. From these results, it is considered that the sparkover in this gap under a lower voltage is only accomplished by forming up the condition for the streamer initiation through the accumulation of metastable molecules in front of the needle tip. The build up of metastable molecule concentration due to the successive injection of avalanches can increase the ionization rate through the energy enhancement of electrons by collisions of the second kind and by cumulative processes. Then the formative characteristics are observed in the sparkover time lag in this gap. (12 refs.)

118775 Quantitative evaluation of the parameters and the deviation of an electric current in a magnetic field. J.Ramos Barrado, A.Monterde Garcia (Facultad de Ciencias, Univ. de Malaga, Malaga, Spain), G.Pardo Sanchez.
An. Fis. Ser. B (Spain), vol.79, no.2, p.101-4 (May-Aug. 1983). In Spanish. [received: Oct. 1983]
A factorial planification to obtain the influence of magnetic field, electric current intensity, pressure, and their interactions, on the deviation of a wall stabilized electric arc is used. Moreover, the authors have calculated an experimental expression to arc displacement in function of electric current density and magnetic field. (9 refs.)

118776 Acoustic impulse generation by electric discharges. L.Sanchez Pina, A.Moreno Arranz, J.Pfretzschner Sanchez (Inst. de Acustica, Consejo Superior de Investigaciones, Cientificas, Madrid, Spain).
An. Fis. Ser. B (Spain), vol.79, no.2, p.141-5 (May-Aug. 1983). In Spanish. [received: Oct. 1983]
This work deals with the generation of acoustic impulses by means of low voltage capacitor discharges across a specially designed graphite resistor and the resulting ionised surrounding fluid. A prototype for the production of detonations is described and the electric features of the process are analysed with regard to the magnitudes of the constitutive elements. The acoustic features are described by means of the peak value and the spectrum of the signal and correlated with the electric quantities. (11 refs.)

118777 Local dependence of rise time of spectral line intensities in Ne glow discharge tube. M.Yamashita (Faculty of Sci. & Technol., Sci. Univ. of Tokyo, Chiba, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1170-5 (July 1983).
The radial dependence of line intensities in an impulsive Ne glow discharge was investigated with particular attention being paid to the initial temporal changes of emissive line intensities. Two kinds of discharge tube, a cylindrical hollow cathode (CHC) tube and a plane disk cathode (PDC) tube, were used. The empirical formulae for the radial dependence of the temporal line intensities before reaching the stationary state are presented, with the experimental confirmation that the well-known simple Bessel function type formula is obtained in the CHC at low pressure in the stationary state. (19 refs.)

118778 Corona threshold voltage of negative DC surface discharge. N.Sugawara, K.Hokari (Dept. of Electrical Engng., Kitami Inst. of Technol., Kitami, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1225 (July 1983).
The corona threshold voltage with a needle and an earthed electrode on the surface of an insulator (the corona threshold voltage of the surface) is presented. The corona threshold voltage of the surface is examined as a function of the gap length, and the influence of discharge on the insulator with and without an earthed conductor on one side (the conductor being a backing electrode) and the insulator materials on the surface corona threshold voltage are dealt with. The voltage between a needle and the blade of a razor electrode on an insulator without a backing electrode is divided by the surface resistance on the insulator. The voltages between electrodes in surface discharge on an insulator with a backing electrode are almost equal to the voltage between the needle and the backing electrode divided by the volume resistance according to the thickness of the insulator, because the thickness of the insulator is less than the shortest gap length in this study. (5 refs.)

118779 Electrical discharge channel in sodium vapor initiated by resonant laser light. H.Tamura, J.Mogi, K.Horioka, K.Kasuya (Dept. of Energy Sci., Tokyo Inst. of Technol., Yokohama, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L417-19 (July 1983).
A z-discharge channel in sodium vapor was initiated by a laser beam, which was tuned to the sodium D resonance line ($\lambda=589$ nm). Applying a voltage sufficiently lower than the self-breakdown voltage, the discharge of $\sim$40 cm in length was initiated by laser radiation of modest power density. Streak-camera photographs showed that the laser-initiated discharge channel was produced just along the laser beam path. It was confirmed that the resonant laser light was very effective for the channel initiation. (12 refs.)

118780 Magnetically confined low-pressure gas discharge generated in a vacuum switch. K.Kageyama (Res. & Dev. Center, Toshiba Corp., Kawasaki, Japan).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1522-8 (1983).
Mode and current paths for a discharge in a vacuum switch placed in a magnetic field were investigated experimentally and analytically to find a possible method for measuring the pressure in the switch. A low-pressure gas discharge is generated in the switch, and discharge properties show evidence that the arc shield, which is electrically floating, is an essential element. Simulators of the vacuum switch were assembled to determine the effects of the shield on the discharge. Pressure dependence and current distributions in various electric-field configurations in the simulators were measured and analyzed. The discharge in the vacuum switch is identified as a series discharge of an inverted magnetron and of a magnetron through the shield as a common electrode. The mode for each elemental discharge is the same as that employed by cold-cathode vacuum gauges. In the inverted magnetron, the current flows from the switch-contact periphery at positive high voltage radially to the shield. In the magnetron, it flows from the shield end radially to the rod of a switch electrode, which is electrically grounded. (4 refs.)

118781 Properties of a series crossed-field discharge in a vacuum switch. K.Kageyama (Res. & Dev. Center, Toshiba Corp., Kawasaki, Japan).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1529-32 (1983).
Properties of low pressure gas discharges generated in a vacuum switch placed in a magnetic field were investigated for an approach to a method of measuring pressure. The discharge was identified in a previous paper as a series crossed-field discharge of an inverted magnetron and of a magnetron. The present experiments reveal discharge-current dependences on pressures, discharge voltages and magnetic-field strengths. These dependences agree well with those deduced from properties of the two elemental discharges that are applicable to pressure measurement. Discharges were generated in various gas species, and discharge-current dependence on gas species was obtained. The series crossed-field discharge was proved to be self-sustaining, and an estimate supports the discharge stability. (3 refs.)

118782 Optical and spectroscopic investigations of a pulsed near-surface discharge at atmospheric pressure. V.B.Avramenko, A.M.Kuz'mitskii, L.Ya.Min'ko (Inst. of Phys., Acad. of Sci., Belorussia SSR).
High Temp. (USA), vol.20, no.6, p.827-31 (Nov.-Dec. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR),* vol.20, no.6, p.1052-6 (Nov.-Dec. 1982). [received: Sept. 1983]
The results of experimental optical and spectroscopic investigations of a pulsed near-surface discharge at atmospheric pressure are given. The course of development and the spectroscopic properties of the near-surface plasma structures are investigated. The distributions of temperature and charged-particle concentration in space and time are obtained. Near-surface and surface discharges are briefly compared. (9 refs.)

118783 Analysis of radial distribution of plasma parameters in a coaxial-line microwave discharge tube. I.Kato, S.Hara, S.Wakana (Dept. of Electronics & Communication Engng., Waseda Univ., Tokyo, Japan).
J. Appl. Phys. (USA), vol.54, no.9, p.4883-8 (Sept. 1983).
The discharge mechanism in a coaxial-line microwave discharge tube that makes uniform plasma along the circumference of the tube has been analyzed. The analysis includes the skin effect of microwave penetration into the plasma and the equilibrium between generation and losses of the charge particles. It is shown that the radial distributions of electron density and electron temperature can be calculated from measured values of the radial distribution of light intensity. The electron density is about 10^{12} cm^{-3} near the center axis of the plasma column and is close to trapezoidal in shape. The electron temperature is about 4×10^4K near the tube wall and decreases monotonically toward the center of the plasma column. (18 refs.)

118784 Measurements of energetic electrons in a magnetized hot filament discharge. R.F.Ellis, D.N.Arion (Lab. for Plasma & Fusion Energy Studies, Univ. of Maryland, College Park, MD, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.4895-901 (Sept. 1983).
Measurements of the energy distribution function of primary electrons in a hot filament discharge in a magnetic field have been made. These results show a smooth distribution function which decreases monotonically with increasing energy up to a value approximately equal to the discharge voltage; the shape of the distribution is independent of other discharge parameters. An ionization kinetics model is used to estimate the energetic electron density, which is shown to vary linearly with plasma density, inversely with fill pressure, and decrease with increasing discharge voltage. At the highest plasma densities bulk heating, possibly due to coulomb drag on primary electrons, is observed. (12 refs.)

118785 Use of electric probes in silane radio frequency discharges. E.R.Mosburg,Jr., R.C.Kerns, J.R.Abelson (Solar Energy Res. Inst., Golden, CO, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.4916-27 (Sept. 1983).
The use of electrostatic probe techniques for measurement of the electron temperature kT_e and the electron density n_e in pure and BF_3 doped silane radio frequency (13.56 MHz) discharges is demonstrated to be feasible even though amorphous silicon is being deposited on the probe surfaces. The required conductivity of such deposited silicon surface layers is examined and compared with the measured photoconductivity and thermally induced conductivity of amorphous silicon. An equation is derived for the double probe current-voltage (*I-V*) curve which includes the first order effect of AC fields and can be used to determine the electron density. During typical depositions of thin films of amorphous silicon from such discharges, values of $kT_e=2\text{-}2.5$ eV and $n_e=(1\text{-}1.5)\times10^9$ cm^{-3} were obtained. These values are consistent with those obtained by other workers using microwave and optical techniques. In BF_3 doped silane an abrupt step is observed in the Langmuir *I-V* curves which indicates the presence of a group of fast, anisotropic electrons. In diborane doped silane, probe measurements become unstable and irreproducible. For this reason the authors investigate a RF probe technique. The advantages and constraints inherent in using this method in their RF discharges are examined and analyzed. (36 refs.)

118786 Particle densities in high current hollow cathode discharges. H.Koch, H.J.Eichler (Optisches Inst., Tech. Univ. Berlin, Berlin, Germany).
J. Appl. Phys. (USA), vol.54, no.9, p.4939-46 (Sept. 1983).
Operating hollow cathode discharges at current densities in excess of 0.1 A/cm^2 leads to an efficient production of metal vapor via the process of cathode sputtering. This method of metal vapor production has been exploited in numerous metal ion laser devices and in spectroscopic light sources. In this paper the main processes involved in high current hollow cathode discharges will be discussed for the special case of a Ne-Cu discharge that can be regarded as representative for other sputtering hollow cathode discharges. Starting from a set of balance equations, expressions for the current density dependence of the spatially averaged buffer gas ion-, metal ion-, and metal atom-density are derived. These expressions are verified experimentally by measurements of the spontaneous emission of a Cu II line and yield in a simple manner realistic data of these particle densities. Finally the obtained results are related to the characteristics of a Cu II laser. (28 refs.)

118787 Generalized theory of first Townsend ionization coefficient in strong electric fields. L.Friedland, J.M.Kagan (Racah Inst. of Phys., Hebrew Univ. of Jerusalem, Jerusalem, Israel).
J. Appl. Phys. (USA), vol.54, no.9, p.4947-50 (Sept. 1983).
A one dimensional model of electron multiplication in a gas in strong electric fields is considered by using the Laplace transform technique. An approximate expression for the first Townsend ionization coefficient is derived and found to be in a good agreement with the experimental data for a variety of atomic and molecular gases. (19 refs.)

118788 Ionization mechanism in a nitrogen glow discharge. H.Brunet, P.Vincent, J.R.Serra (Labś. de Marcoussis, Compagnie Generale d'Electricite, Marcoussis, France).
J. Appl. Phys. (USA), vol.54, no.9, p.4951-7 (Sept. 1983).
The electron distribution function has been calculated in nitrogen taking into account collisions of electrons with vibrationally excited molecules. Transport coefficients, vibrational excitation rates, excitation rates for the lowest-lying electronic states, and direct ionization rates are presented as a function of E/N (electric field to gas density ratio) for different values of the vibrational temperature. At low E/N values, a very large increase of the direct ionization rate is observed due to the rise of the tail of the electron distribution in presence of large vibrational populations. Ionization processes occurring in the collision of metastable molecules have also been investigated. It is concluded that in most glow discharge, ionization occurs mainly from associative ionization produced by collision between two metastable molecules in the $a'\Sigma_u^-$ state. Ionization due to collisions of electrons with metastable molecules was found to be unimportant because of the low concentration of metastable molecules in glow discharges. (15 refs.)

118789 Monte-Carlo simulation of electron properties in RF parallel plate capacitively coupled discharges. M.J.Kushner (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.4958-65 (Sept. 1983).
Electron properties in a parallel plate capacitively coupled RF discharge are studied with results from a Monte-Carlo simulation. Time averaged, spatially dependent electron distributions are computed by integrating, in time, electron trajectories as a function of position while oscillating the applied electric field at RF frequencies. The DC component of the sheath potential is solved for in a self-consistent manner during the simulation. For conditions where the secondary emission coefficient for electrons from the electrodes is large, the electron distribution is spatially differentiated, being dominated by an *e*-beam component near the electrodes while being nearly in equilibrium with the applied electric field in the body of the plasma. The DC component of the sheath potential is found to be a function of the ratio λ/d, where λ is the electron mean free path and d is the electrode spacing. (25 refs.)

118790 Isotope separation in a low-pressure DC discharge. A.I.Karchevskii, E.P.Potanin.
Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.553 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1286-8 (Nov. 1982). [received: Sept. 1983]
Recent successful experiments on the separation of isotopic mixtures of inert gases have attracted interest to the separation properties of DC discharges. The authors examine an isotope-separation mechanism in the positive column of a DC discharge for the case of a relatively low pressure, at which the ion mean free path is much larger than the radius of the discharge tube and at which the particle collision rate in the volume is low in comparison with the rate at which the particles collide with the wall. In this case the difference between the degrees of ionization of the different isotopes is determined by the different rates at which heavy and light ions are lost from the discharge. The rate at which the light particles collide with the wall and thus the recombination rate of the light particles are higher than those of the heavy particles. To estimate the magnitude of the effect the authors work from the continuity equations for the ions of each species of a binary isotopic mixture, under the assumption that the radial electric field in the positive column has a negligible effect on the transverse ion drift and thus on the rate at which the ions collide with the wall. (5 refs.)

118791 Calculation of the electric arc characteristics in a cylindrical channel taking into account radiation based on the three-layer model. N.F.Aleshin, A.F.Bublievskii.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.68-72 (1983). In Russian.
The three-layer model disregarding the axial temperature gradient component is used to obtain analytical expressions for calculating electric arc characteristics with allowance for radiation in the volumetric approximation. The results obtained are compared with the numerical calculation and two-layer model. (5 refs.)

A capillary discharge thermonuclear burner .... See Entry 117699

Stark broadening of lines from multiply-charged carbon ions in a high-density arc plasma .... See Entry 117829

Stark broadening of the Paschen-beta line of hydrogen in a linear discharge .... See Entry 117830

Penning collisions in hollow cathode He-Cd$^+$ lasers .... See Entry 118124

Visible iodine and bromine laser, and coaxial discharge excited strong UV iodine laser .... See Entry 118126

Investigation of lasing in active media utilizing transitions in manganese atoms .... See Entry 118129

Spectral quality of He-Zn II and He-Cd II hollow cathode metal vapor lasers in the magnetic fields .... See Entry 118188

Calculation of electron swarm parameters in fluorine .... See Entry 118704

On hydrogen recycling and gas desorption in a glow discharge .... See Entry 118735

Nonlinear plasma spectroscopy of the hydrogen Balmer-α line .... See Entry 118750

Spectroscopic measurement of hydrogen contamination in weld arc plasmas .... See Entry 118755

A new reimaging technique for measurement of the radial density distribution of metastable states .... See Entry 118757

Gain and loss kinetics in a pulsed discharge by scanning in time with a probing laser pulse .... See Entry 118759

Optogalvanic double-resonance spectroscopy in a neon discharge .... See Entry 118763

Investigation of electron spectra of chemi-ionization processes in the afterglow plasma .... See Entry 118765

60.00 CONDENSED MATTER: STRUCTURE, THERMAL AND MECHANICAL PROPERTIES

61.00 STRUCTURE OF LIQUIDS AND SOLIDS; CRYSTALLOGRAPHY

(see also 68.20 Solid surface structure, 71. Electron states)

118792 Constrained density modifications by variational techniques. J.Navaza, E.E.Castellano, G.Tsoucaris (Lab. de Phys., Tour B, Centre Univ. Pharmaceutique, Chatenay Malabry, France).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.622-31 (1 Sept. 1983).
A general method for phase extension and refinement is described. It consists of minimizing a conveniently defined functional M by the steepest-descent or conjugate-gradient techniques. This functional consists of a term $R={}^1/_2\Sigma(|F|-|F^{\text{obs}}|)^2$ plus any given number of constraint equations selected according to the requirements of the particular problem considered. Several examples of the introduction of constraints are described in detail, both in direct and reciprocal space, and a few one-dimensional tests provide insight in the behavior of the different alternatives. Also, some general features that the calculated electron density function should fulfil, such as positivity and boundness, are directly introduced without the need of terms other than R in the functional M. The connection between this approach and the ones which use the principle of maximum entropy is discussed. A critical analysis shows that those methods are just different ways of minimizing R with the constraints of positivity. (18 refs.)

118793 From a partial to the complete crystal structure. C.Giacovazzo (Istituto di Mineralogia e Petrografia, Univ. di Bari, Bari, Italy).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.685-92 (1 Sept. 1983).
The joint probability distribution method is applied in order to estimate phases when part of the crystal structure is correctly positioned. The mathematical approach is briefly described and the conclusive formulas are compared with those given by previous authors. (18 refs.)

118794 Correct calculation of scale factor between diffraction data sets of isomorphous crystals and its application to protein crystallography. S.V.Nikonov (Inst. of Protein Res. Acad. of Sci., Moscow, USSR).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.693-7 (1 Sept. 1983).
A correct calculation of the scale factor between the diffraction data of isomorphous crystals is shown on the basis of a statistics criterion. This scale factor requires no additional refinement, improves the signal-to-noise ratio of difference Patterson maps and Wilson's statistics and allows an estimation of the degree of non-isomorphism. The method has been tested for the 3 Å data sets of protein γ-crystallin crystals and a few of its heavy-atom isomorphous derivatives. (12 refs.)

118795 The effect of finite detector slit height on peak positions and shapes in powder diffraction. E.Prince (Nat. Measurement Lab., NBS, Washington, DC, USA).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.508-11 (1 Oct. 1983).
The finite height of the detector slit of a powder diffractometer has three observable effects: (1) the peak is shifted by an amount that is proportional to $-\cot 2\theta$; (2) the peak is broadened by an amount proportional to $\cot^2 2\theta$; (3) an asymmetry is introduced into the peak shape that depends on $\cot^3 2\theta$. If the underlying instrumental resolution function has a Gaussian shape, the slit height effects can be approximated, over a rather broader range of shapes for the vertical resolution function, by an Edgeworth series making use of one adjustable parameter. This peak shape function is compared with experimental observations and with other shape functions that have been proposed. A well characterized peak shape is at least as important as resolution when the data are to be used for structure refinement by the Rietveld technique and diffractometers should be designed so as to keep the slip height within the range that leads to shapes that can be described mathematically. Diffrac-

tometers with multiple detectors can usefully have different vertical divergences for detectors that cover different angular ranges. (10 refs.)

118796 A geometric method incorporated with a computer program for indexing crystal faces of microcrystallites. S.Simov (Inst. of Solid State Phys., Bulgarian Acad. of Sci., Sofia, Bulgaria), E.Simova, B.Davidkov, G.Mechenov.
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.559-62 (1 Oct. 1983).
A way of indexing microcrystallites is described in which analytical geometry is used. Two micrographs obtained at different tilting angles of the object are considered as the two orthogonal projections of the object on the *XOY* plane of a Cartesian coordinate system. The abscissae and the ordinates of three noncollinear points of each indexable habit face are determined by direct measurement and the *Z* coordinates are calculated. The habit faces are regarded as planes in three-dimensional space and the angle between each pair of indexable faces is calculated. The indexing is performed by comparing the calculated angles between the habit faces and the angles between the already known equilibrium planes (predicted by the theory). A computer program for experimental data processing is briefly described. (18 refs.)

118797 Development of new management system for Cambridge crystallographic database. Y.Watanabe, T.Suzuki, M.Noguchi.
Rep. Inst. Phys. & Chem. Res. (Japan), vol.59, no.4, p.138-57 (1983). In Japanese.
A new Management System for Cambridge Crystallographic Database (XCDB) is developed as an integration of two subsystems, XCDB search and retrieve system and XCDB maintenance system with the following features in its design: (1) It makes possible the high speed retrieval by direct access to XCDB file (60 MB or more) using BSAMLIB, a routine developed in this Institute for direct access to the sequential dataset with undefined length record. (2) Several simple users' commands (XCDB search/retrieve commands and input/output control commands) are provided. (12 refs.)

PARST: a system of FORTRAN routines for calculating molecular structure parameters from results of crystal structure analyses ....See Entry 118002

61.10 X-RAY DETERMINATION OF STRUCTURES

(see also 61.80 Radiation damage and other irradiation effects; for specific determinations, see 61.55 to 61.80)

61.10D Theories of diffraction and scattering

118798 X-ray reflection curves of crystals with randomly distributed microdefects in the Bragg case. V.Holy (Dept. of Solid State Phys., J.E. Purkyne Univ., Brno, Czechoslovakia).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.642-6 (1 Sept. 1983).
The formalism of the optical coherence has been applied to the description of the Bragg-case dynamical X-ray diffraction from crystals with randomly distributed amorphous spheres. Explicit formulas have been found for the reflection curves of such crystals in the first and second approximations of the iterative solution of the Takagi equations. It is shown that if the coherent plane wave falls on the crystal the diffracted wave consists of two parts—the plane coherent wave (which corresponds to the diffraction from a perfect crystal with a modified value of the Debye-Waller factor) and the partially coherent wave (diffusion scattering). The form of the partially coherent contribution to the reflection curve is discussed and its dependence on the defect diameter and the defect concentration. From the curves the integrated intensities are obtained. It is proved that the integrated intensity of the waves diffracted from such crystals depends linearly on the relative disturbed volume of the crystal and in the first approximation it does not depend on the defect diameter if this volume remains constant. (9 refs.)

118799 Theoretical study of the influence of the width of the entrance slit on the contrast of dislocations in X-ray topography by means of simulations. Y.Epelboin, A.Authier (Univ. Pierre et Marie Curie, Paris, France).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.767-72 (1 Sept. 1983).
Experimental topographs may be simulated by addition of simulations where one point source is lit on the surface of the crystal. The accuracy of a varying-step integration of Takagi equations is good enough to allow such computations. It is shown that all parts of the contrast are sensitive to the width of the entrance slit and that accurate characterization of defects must take this parameter into account. (15 refs.)

118800 General calculation of the polarization factor for multiple coherent scattering of unpolarized and plane-polarized X-rays. C.W.Dwiggins,Jr. (Bartlesville Energy Technol. Center, USDOE, Bartlesville, OK, USA).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.773-7 (1 Sept. 1983).
The polarization factor for coherent scattering from a crystalline or noncrystalline sample can be calculated easily for any number of pre- and post-sample scatterers of any orientation. No complicated visualization is necessary. Either an analytical or a numerical method can be used. Simple repeated matrix multiplication is used to determine the polarization factor. The technique is illustrated for a Bonse-Hart instrument having 13 scattering processes. (16 refs.)

118801 The intensity enhancement of diffracted wave of X-rays at the rear surface. T.S.Uragami (Faculty of Sci., Okayama Univ. of Sci., Okayama, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3073-9 (Sept. 1983).
The intensity distribution of wave field in a perfect crystal of rectangular form is calculated for a very narrow incident wave by numerically solving Takagi's equations. The result is displayed by the graphics and interpreted in comparison with the analytic solutions of the partial differential equations. Most part of the incident wave propagates straight without being diffracted inside the crystal even when it satisfies the Bragg condition. Upon hitting a side face of the rectangular crystal it is shown to be reflected back inside the crystal and to interfere with the Bragg diffraction already excited in the crystal. (18 refs.)

61.10F Experimental techniques

(inc. apparatus, techniques and calculation methods for analyzing experimental results; see also 07.85 X-ray, gamma-ray instruments and techniques)

118802 Cooperative programming in crystallography. R.A.Alden, G.Bricogne, S.T.Freer, S.R.Hall, W.A.Hendrickson, P.A.Machin, R.J.Munn, A.J.Olson, G.N.Reeke,Jr., S.Sheriff, J.M.Stewart, J.Sygusch, L.F.TenEyck, K.D.Watenpaugh (Scripps Clinic & Res. Found., La Jolla, USA).
Comput. & Chem. (GB), vol.7, no.3, p.137-48 (1983).
Under the auspices of the National Resource for Computation in Chemistry a group of 14 X-ray crystallographers convened in a series of workshops to explore and exercise means of producing computer software for general use in their field that would alleviate many of the problems facing scientific programmers in an ever changing computational environment. The group has succeeded in cooperatively producing a comprehensive computer program for the solution of the multiple isomorphous replacement phasing of macromolecular crystal structures. The techniques employed allow the program to be run in virtually any scientific computing environment and are applicable to other scientific fields. The project is discussed in terms of its successes and failures. (38 refs.)

118803 Real-time X-ray topography: applications to bulk HgCdTe materials. R.G.Rosemeier (Brimrose Corp. of America, Baltimore, MD, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1656-60 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
Commercially available portable image X-ray intensifiers have found their usefulness with all existing X-ray topographic techniques. Real-time X-ray topography can be employed to align the diffraction images rapidly before recording them on high resolution film. As a before recording them on high resolution film. As a quality control procedure, real-time Berg-Barrett X-ray topography can be used to assess macrostructural quality of HgCdTe with approximately 100 μm spatial resolution. As a X-ray screening technique prepared samples of HgCdTe can be assessed in real time before undergoing unnecessary costly processing on poor material. The advantages and disadvantages of the three basic types of X-ray topographic system will be discussed. The usefulness of real-time X-ray intensification as a support tool to Berg-Barrett, Lang, and ACT topography techniques is evaluated. Also, instrument characteristics of the X-ray intensifiers which are useful in real-time X-ray topography applications will be presented. (16 refs.)

118804 The experimental determination of the phases of X-ray reflections. B.Post (Phys. Dept., Polytech. Inst. of New York, New York, NY, USA).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.711-18 (1 Sept. 1983).
The application of dynamical diffraction theory to the 'phase problem' for centric crystals shows that the intensities diffracted in simultaneous three-beam interactions display characteristic maxima and minima. The sequence in which these appear on chart recordings is a sensitive function of the phase of the triplet involved in the interaction. The sequence is the same for all triplet phases of the same sign; it is reversed for those of the opposite sign. In earlier work a number of triplet phases in perfect crystals were determined. In the present work, several hundred triplet phases in mosaic crystals have been determined. (14 refs.)

118805 Polarization ratios for repeatedly reflected X-ray beams. J.L.Lawrence (Dept. of Phys., Univ. of St. Andrews, St. Andrews, Scotland).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.753-5 (1 Sept. 1983).
The polarization ratio for a repeatedly reflected X-ray beam has been calculated, assuming the Darwin formulism, in the case where the diffracting planes of the crystals are parallel. It is shown that polarization ratios lie closer to unity than those obtained using the kinematic approximation. The integrated intensities and polarization ratios from a double-crystal spectrometer are discussed. The polarization ratio for a graphite monochromator has been measured experimentally and shown to be close to the value predicted by the Darwin theory and significantly different from the kinematic value. (8 refs.)

118806 An alternative approach to the quantitative determination of grain-size distribution in X-ray diffraction? A comment. E.F.Bertaut (Lab. de Cristallographie, Univ. Sci. et Medical Grenoble, Grenoble, France).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.818-19 (1 Sept. 1983).
The paper by Zhao, Lu and Lagally [Acta Cryst. (1982), A38, 800-802] is commented on and compared with a previous paper by Bertaut [Acta Cryst. (1950), 3, 14-18]. (8 refs.)

118807 Study of the swelling of vermiculite-ornithine in salt solution by small-angle X-ray scattering analysis. Method of interpretation and investigation of the order parameters. J.Saez-Aunon (CSIC, Grupo di Fisico-Quimica Mineral, Madrid, Spain), C.H.Pons, J.E.Iglesias, J.A.Rausell-Colom.
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.439-48 (1 Oct. 1983). In French.
A method of interpretation is presented for the small-angle scattering patterns of vermiculite-ornithine gels. The method has been applied to the results obtained from a vermiculite from Malawi. The distribution of spacings between parallel first-neighbour silicate layers can be described by three order parameters, whose values are found by analysing the experimental modulation functions. The variation of these order parameters with the salt concentration of the suspension should allow one to specify the swelling process as well as the relationship between the crystal chemical properties of the silicate and its behaviour as a colloid. (20 refs.)

118808 X-ray Rietveld refinement using Debye-Scherrer geometry. P.Thompson, I.G.Wood (Clarendon Lab., Univ. of Oxford, Oxford, England).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.458-72 (1 Oct. 1983).
A procedure for Rietveld refinement from Debye-Scherrer X-ray diffraction patterns is described, in which the effects of instrumental aberrations on the peak shapes and positions are calculated and incorporated into the refinement model. These aberrations, neglected in previous Rietveld refinement programs, can produce severe systematic errors in both the structural and nonstructural parameters derived. Results presented from four materials (SiO_2, $AlPO_4$, Al_2O_3, $LiTaO_3$) are in good agreement with single-crystal values and are an improvement over those previously obtained by X-ray powder diffraction. (60 refs.)

118809 An absolute intensity standard for small-angle X-ray scattering measured with position-sensitive detectors. T.P.Russell (IBM Res. Lab., San Jose, CA, USA).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.473-8 (1 Oct. 1983).
Silica sols have been evaluated as a means of determining the incident beam intensity using position-sensitive detectors. Analysis of the total integrated small-angle X-ray scattering yielded an electron density of the suspended

silica particles that was within 4% of the electron density of amorphous silica. The sols were found to be particularly well suited for use with position-sensitive detectors and represent a convenient, rapid, and accurate means to determine the incident beam intensity. (30 refs.)

118810 A computer X-ray quantitative phase analysis. Z.Weiss, J.Krajicek (Coal Res. Inst., Ostrava-Radvanice, Czechoslovakia), L.Smrcok, J.Fiala.
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.493-7 (1 Oct. 1983).
A computer-based method of X-ray quantitative phase analysis which utilizes the whole powder diffraction pattern including overlapping diffractions is described. The measured intensities are compared with those obtained from the calculations based on single-crystal investigations. Three examples are included showing the analyses of artificially prepared mixtures of quartz, micas, chlorites, carbonates and kaolinite. (17 refs.)

118811 The doping method in quantitative X-ray diffraction phase analysis. Addendum. S.Popovic, B.Grzeta-Plenkovic (Ruder Boskovic Inst., Zagreb, Yugoslavia), T.Balic-Zunic.
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.505-7 (1 Oct. 1983).
A specific case of the doping method (Popovic and Grzeta-Plenkovic, 1979) is elaborated, in which the weight fraction of a crystalline component in the multicomponent system can be determined from the measurement of diffraction line intensities of that component only. Optimum conditions to attain maximum accuracy of the doping method are discussed. (3 refs.)

118812 Diffraction line profiles and Scherrer constants for materials with hexagonal crystallites. R.Vargas, D.Louer (Lab. de Cristallochimie, Univ. de Rennes I, Rennes, France), J.I.Langford.
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.512-18 (1 Oct. 1983).
Diffraction line profiles and Scherrer constants for use with various measures of diffraction broadening are derived for right hexagonal prisms. A method is described for obtaining the size of crystallites with this form and a comparison is made with a cylindrical model. The technique is applied to annealed ZnO powder obtained from the thermal decomposition of $Zn_3(OH)_4(NO_3)_2$. The Fourier method is used to show that the crystallites are hexagonal prisms with an average height and edge length of 213 and 87 Å and with the z axis parallel to the axis of the prism and x or y parallel to an edge. (20 refs.)

118813 Eccentricity corrections for a modified Debye-Scherrer camera. L.K.Frevel (Dept. of Chem., Johns Hopkins Univ., Baltimore, MD, USA).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.532-4 (1 Oct. 1983).
By substituting a thin flat powder specimen for the conventional cylindrical sample in a modified Debye-Scherrer camera (Frevel et al., 1982), well defined diffraction profiles representative of the entire sample are obtained. The peak of such a diffraction profile can be measured quite accurately so that for that reflection the effective center of the diffracting sample may be determined from the bracketing diffraction peaks of an internal standard. (6 refs.)

118814 Detector aperture size in the conventional estimation of integrated intensity in the $\omega/2\theta$ scan mode. A.McL.Mathieson (Div. of Chem. Phys., CSIRO, Clayton, Victoria, Australia).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.572-3 (1 Oct. 1983).
In respect of the traditional wide-aperture procedure for the measurement of integrated intensity, the practice of varying the detector aperture width from reflection to reflection as a function of tan θ is shown to be erroneous in relation to the $\omega/2\theta$ scan mode: in most cases, no adjustment is needed at all. (7 refs.)

118815 Error in 2θ from single-crystal diffractometers due to sample absorption in a divergent primary beam. C.Svensson (Inorganic Chem., Univ. of Lund, Lund, Sweden).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.573-5 (1 Oct. 1983).
The primary-beam divergence of an X-ray four-circle diffractometer is the source of an error in the measured scattering angles from absorbing single crystals. A correction for this error is included in a least-squares program for lattice-constant determination. It is shown with α-$LiIO_3$ as an example that both accuracy and precision are enhanced. The 2θ corrections are typically as large as 0.03° for a spherical crystal with $\mu R=1.5$ and $R=0.15$ mm. The results indicate an obtainable accuracy of about 0.02% in lattice constants even if $\mu R \gtrsim 1$. (11 refs.)

118816 A computer program generating parameters useful in X-ray diffraction topography studies. K.J.Roberts (Dept. of Pure & Appl. Chem., Univ. of Strathclyde, Glasgow, Scotland).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.577-8 (1 Oct. 1983).
A simple Fortran computer program XRTDAT is described. This program generates data useful in the planning, execution and interpretation of an X-ray topographic experiment. (6 refs.)

118817 A simplified sample cooling system for X-ray diffraction experiments. Y.Yoshimura, N.Tsuda, K.Shimaoka (Dept. of Math. & Phys., Ritsumeikan Univ., Kyoto, Japan).
Mem. Res. Inst. Sci. & Eng. Ritsumeikan Univ. (Japan), no.41, p.21-6 (1982).
Low temperature sample cooling was successfully stabilized using a cold nitrogen gas system without electronically automated control. The system is useful for short time as well as long time X-ray diffraction experiments above about liquid nitrogen temperature up to about 500K. A perfect prevention from moisturing or frost condensation onto the sample can be realized in the regular air-conditioned laboratory. An insignificantly small temperature change was seen only in the case of refilling liquid nitrogen in the gas generator Dewar, the limits of temperature fluctuation being within 0.5K. The lowest temperature experiments, at 85K, were able to be carried out for about 10 hours with 3 liters per hour consumption of liquid nitrogen. (3 refs.)

118818 Manifestation of X-ray absorption in calcium hexaboride and lanthanum hexaboride. Yu.B.Paderno, I.G.Barantseva, E.M.Dudnik, L.I.Kopylova, L.V.Strashinskaya (Inst. of Materials Sci., Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.22, no.2, p.119-22 (Feb. 1983). Translation of: *Poroshk. Metall. (USSR)*, vol.22, no.2, p.50-4 (Feb. 1983). [received: Sept. 1983]
The effect of specimen size on the intensity of X-ray reflections was studied by comparing theoretically calculated and experimentally measured intensities of X-ray photograph lines of specimens of various diameters. It is concluded that the absorption factor must be taken into account in calculations of the X-ray line intensity of the hexaborides of rare-earth metals. In physical investigations involving analyses of the intensities of X-ray lines of materials with low coefficients μ it is necessary to employ only solid, nonporous specimens of regular geometric shape. Approximation of irregular specimen shapes with regular shapes bearing a more or less close resemblance to them cannot be recommended owing to the possibility of calculated intensities differing significantly from real ones. (4 refs.)

Monolithic double-grooved-crystal monochromators with tunable harmonic suppression for neutrons and X-rays .... See Entry 117298

A focusing Weissenberg camera with multi-layer-line screens for macromolecular crystallography .... See Entry 117299

A small-angle camera for resonant scattering experiments at the storage ring DORIS .... See Entry 117300

A remote-control direct-beam exposure device for the Arndt-Wonacott rotation camera .... See Entry 117301

Geometrical aspects of thermal diffuse scattering and the associated γ-ray and X-ray Kikuchi effects near a Bragg reflexion .... See Entry 118826

61.12 NEUTRON DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

118819 Theory of multilayer neutron monochromators. V.F.Sears (CAECL, Chalk River, Ontario, Canada).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.601-8 (1 Sept. 1983).
The theory of the reflecting properties of multilayer monochromators is developed on the basis of both the kinematical and the dynamical theory of neutron scattering with emphasis on the way in which the flux and polarization of the reflected beam depends on the parameters that characterize the multilayer. The effect of random variations in layer thickness is investigated using a cumulant expansion method. The contamination of the reflected beam due to both higher-order Bragg reflections and specular reflection is also discussed. (6 refs.)

118820 Assessment of parameter accuracies in profile analysis of white-beam neutron powder diffraction experiments. H.Poyry (Reactor Lab., Tech. Res. Centre of Finland, Espoo, Finland), K.J.Tilli.
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.479-85 (1 Oct. 1983).
One of the problems arising in profile analyses of white-beam powder diffraction experiments is that in order to assess the reliability of the refined structure parameters allowance must be made not only for errors in the actual powder data but also for uncertainties in the various wavelength-dependent corrections involved. As a means for such assessments the authors' work provides a general method in which the incident white neutron flux spectrum is assumed to be measured and combined with the other wavelength-dependent factors to form a set of effective incident intensities with known statistical properties for the diffraction peaks. Given that appropriate models are used for both the powder spectrum and the effective fluxes, the unknown model parameters and their accuracies can be estimated optimally through a single least-squares fit of the available experimental data. By applying the formalism to a real nickel powder measurement, it was shown that the precision of the parameter estimates may depend considerably on the errors of the wavelength-dependent corrections, unless these are known with much higher accuracies than the diffraction pattern. In the example this provided true especially for the scale factor and the temperature factor. (20 refs.)

118821 A medium-resolution double-crystal diffractometer for the study of small-angle neutron scattering. J.Kulda, P.Mikula (Nuclear Phys. Inst., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.498-504 (1 Oct. 1983).
The angular resolution of the parallel (1,-1) double-crystal setting has been relaxed from the original value of 10 μrad for perfect silicon crystals into the region 0.1-1 mrad by their elastic deformation. The totally reflecting region of the dynamical diffraction curve is broadened proportionally to the deformation while the wings as well as the diffuse scattering intensity are not affected substantially. This experimentally verified fact causes gain both in intensity and the signal/noise ratio. First experiments were performed with bent Si single-crystal bars in symmetric 220 reflection geometry at $\theta_B=16.7°$. With the bending radii of the order of 100 m, an angular resolution of 0.6 mrad and an effective neutron flux at the sample position of 400 $mm^{-1}\ s^{-2}$ were achieved. These values do not depend on beam cross section. (15 refs.)

118822 Analysis of anisotropy of small-angle neutron scattering of polyethylene single crystals. D.M.Sadler (H.H. Wills Phys. Lab., Univ. of Bristol, Bristol, England).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.519-23 (1 Oct. 1983).
A method is described which provides an efficient way of analysing degrees of anisotropy in small-angle scattering. It is applied to isotopic mixtures of polyethylene crystallized from solution, and to the same system which has been annealed (heat treated). The degree of orientation of the lamellar crystallites is measured separately. The results can then be given in terms of molecular dimensions along and at right angles to the lamellar normals. It is found that each molecule is probably restricted to one lamella, and than its dimension along the lamellar normal increases on annealing. (11 refs.)

Monolithic double-grooved-crystal monochromators with tunable harmonic suppression for neutrons and X-rays .... See Entry 117298

Theoretical investigations of the dynamical neutron diffraction by magnetic single crystals .... See Entry 119818

61.14 ELECTRON DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

118823 Electron channeling contrast in characteristic energy-loss intensity investigated by the rocking-crystal method. M.Brunner, W.Hylla, H.-J.Kohl (IBM Thomas J. Watson Research Center, Yorktown Heights, NY, USA), H.Niedrig, D.Wendtland.
Scanning Electron Microsc. (USA), pt.1, p.99-104 (1983). (Scanning Electron Microscopy 1983 Conference, Dearborn, MI, USA, 17-22 April 1983).
Electron channeling patterns have been recorded using the rocking-crystal method. From thin crystals not only backscattered but also transmitted and forward scattered electrons are detected in these experiments. The mechanical rocking technique allows the recording of convergent-beam patterns (zones-axis patterns) by detecting the transmitted direct-beam intensity. Electrons with a preset energy window can be selected for signal production using a magnetic energy analyzer underneath the crystalline sample. Patterns have been obtained detecting energy filtered electrons which show the dependence of energy loss signals on the crystal orientation. (19 refs.)

61.14D Theories of diffraction and scattering

118824 The contrast of defects in inelastically scattered electrons. P.Rez (Dept. of Materials Sci., Univ. of California, Berkeley, CA, USA).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.697-706 (1 Sept. 1983).
The theory for the contrast of stacking faults and dislocations in electrons which have been scattered inelastically is derived. Small-angle plasmon and single-electron scattering show similar contrast to the elastically scattered electrons. Phonon scattering by large angles away from strongly excited Bragg reflections shows reversed contrast and small-angle phonon scattering gives better contrast for defects near the top of the specimen. (28 refs.)

61.14F Experimental diffraction and scattering

118825 Analysis of time-dependent images of $NbSe_3$. J.W.Steeds, K.K.Fung, S.McKernan (Dept. of Phys., Univ. of Bristol, Bristol, England).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1623-9 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The properties of time dependent 'strands' and 'fringes' in satellite dark field electron microscope images is described and the interpretation of these features is discussed. (5 refs.)

The determination of crystallographic textures from selected areas of a specimen by electron diffraction .... See Entry 120348

61.16 OTHER DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

118826 Geometrical aspects of thermal diffuse scattering and the associated γ-ray and X-ray Kikuchi effects near a Bragg reflexion. S.W.Wilkins, L.T.Chadderton (Div. of Chem. Phys., CSIRO, Clayton, Victoria, Australia), T.F.Smith.
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.792-800 (1 Sept. 1983).
Sharp dips which are observed in inelastic thermal diffuse γ-ray scattering intensities, and which move rigidly when the crystal is rotated, are attributed to a γ-ray Kikuchi effect. Some geometrical aspects of the effect are explored using the $(\Delta 2\theta, \Delta\omega)$ approach recently developed by Mathieson [Acta Cryst. (1982), A38, 378-87] for dissecting a Bragg reflexion. In particular, it is shown that observation of the effect should not be very sensitive to angular divergence of the incident γ-ray beam, but should depend on the effective source size, the angular resolution of the detector and on basic crystal properties such as size, absorption coefficient and mosaicity. Some useful general results for coordinate transformations between reciprocal space and $(\Delta 2\theta, \Delta\omega)$ space are also presented. (41 refs.)

118827 The symmetry of convergent-beam electron diffraction patterns from bicrystals. F.W.Schapink, S.K.E.Forghany (Lab. of Metall., Delft Univ. of Technol., Delft, Netherlands), B.F.Buxton.
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.805-13 (1 Sept. 1983).
A discussion of the relationship between the symmetry of bicrystals and the resulting symmetry of convergent-beam electron diffraction (CBED) patterns is presented. For this purpose bicrystal symmetry is defined from the symmetry of the dichromatic pattern or complex formed by the interpenetrating lattices or structures of the individual crystals in a bicrystal. The interrelation between the possible coloured point groups and the diffraction groups, characterizing the symmetry of a CBED pattern, is established. Thee results are illustrated by a determination of the symmetry of thin twinned Au crystals from suitable CBED patterns. (21 refs.)

61.16D Electron microscopy determinations

118828 On the identification of numerical simulation of contrasts visible in crystalline interfaces. R.Bonnet (Inst. Nat. Polytech. de Grenoble, Grenoble, France).
J. Microsc. & Spectrosc. Electron. (France), vol.8, no.3, p.147-58 (1983). In French. (Meeting of the French and Belgian Societies for Electron Microscopy, Liege, Belgium, 16-19 May 1983).
The numerical treatment of conventional transmission electron microscope images obtained from two-beam diffractions is well known since the work of Howie and Whelan (1961). However, it is the Australian team which is at the origin of the technic of computed electron micrographs (Head et al, 1973; Humble and Forwood, 1975) making it possible to reproduce visually the detailed contrasts of the boundary dislocations or the rigid body translations at boundaries. The interest, the improvements and the limits of this method are discussed in the frame of recent works involving twin and high angle boundaries. (48 refs.)

118829 Principles and applications of electron holography. K.-J.Hanssen (Phys.-Tech. Bundesanstalt, Braunschweig, Germany).
Phys. Bl. (Germany), vol.39, no.8, p.283-8 (Aug. 1983). In German.
All the important processes of conventional optical holography can also be employed in electron microscopy, where they are applied to the study of electrical and magnetic structures with a resolution down to 2 mm. However, the original concept of electron holography, i.e. to improve the resolution of electron microscope photographs, has not so far been achieved. The main reason for this is the large amount of noise in the holographic reconstruction, particularly in the atomic region. This stems basically from the distribution of the grain accumulations which develop on the hologram plates during electron irradiation. It is hoped that this difficulty will be overcome when grainless or fully electronic recording processes are available. (15 refs.) *D.J.B.*

Scanning Electron Microscopy 1983 Conference .... See Entry 116926

Mobile detector for a scanning electron-beam microscope ..... See Entry 117285

A chemical thinning technique for transmission electron microscopy cross-sectional samples .... See Entry 117287

Analysis of time-dependent images of $NbSe_3$ .... See Entry 118825

Grain boundaries structure observed by high resolution electron microscopy .... See Entry 119027

61.20 CLASSICAL, SEMICLASSICAL, AND QUANTUM THEORIES OF LIQUID STRUCTURE

(for kinetic and transport theory, see 51.10; for electronic states, see 71.; for liquid helium, see 67.)

118830 Excess free volume and intermolecular interaction for some binary molten metal halide mixtures. S.N.Shrivastava, J.D.Pandey (Dept. of Chem., Bipin Behari Coll., Jhansi, India).
Acoust. Lett. (GB), vol.6, no.12, p.178-81 (June 1983).
The concept of free volume has been applied to some binary molten metal halide mixtures. Bockris' relation for the free volume of molten metal salts has been extended to the evaluation of free volume in binary molten metal halide mixtures. The Eyring-Kincaid relation has also been used for the calculation of free volume for the same mixtures. The intermolecular interaction study has been made through the excess free volume for the binary molten metal halide mixtures. The results are consistent with the theories. (12 refs.)

118831 On the coupling between the double layer and the solvent polarization fields. D.Schiby, E.Ruckenstein (Dept. of Chem. Engng., State Univ. of New York, Buffalo, NY, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.277-81 (9 Sept. 1983).
An approach is developed to incorporate in the standard theory of the double layer the effect of the solvent polarization. This polarization is due to a source of polarization on the surface and to the charges in the diffuse layer. The new equations lead to the conclusion that a diffuse layer can be generated even in the absence of a surface charge as long as there is some source of polarization on the surface, such as a layer of dipoles. The solvent polarization also changes the surface potential. (9 refs.)

118832 Symposium on the Hydrophobic Interaction.
Faraday Symp. Chem. Soc. (GB), no.17 (1982). [received: Sept. 1983]
Conference held at: Reading, Berks., England. Date 15-16 Dec. 1982. The following topics were dealt with: historical perspective of hydrophobic interactions; vapour pressure measurements of solubilisation; NMR investigation of clathrates; cage model for solutions; isothermal transport in solutions; thermodynamics of cavity formation; molecular librations and solvent orientational correlations; Monte Carlo computer simulation of the hydrophobic effect; geometric relaxation; hydrophobic moments and protein structure; Kirkwood-Buff theory applications; film pressures of ionic surfactants; dilute polymer solutions; haemoglobin conformational and functional properties. 16 papers are published in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

118833 Molecular librations and solvent orientational correlations in hydrophobic phenomena. P.J.Rossky, D.A.Zichi (Dept. of Chem., Univ. of Texas, Austin, TX, USA).
Faraday Symp. Chem. Soc. (GB), no.17, p.69-78 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
A detailed analysis of the energetic characteristics associated with the solvent in a simulation of a solution containing a pair of apolar spheres immersed in ST2 water solvent is presented. The spheres are separated by a distance corresponding to the so-called solvent-separated hydrophobic interaction. The analysis of local structure is facilitated by the consideration of only near-neighbour solvent-solvent interactions and the use of a coarse-grained time-averaging procedure which removes the high-frequency librational excitation from the underlying hydrogen-bond network. The structure produced is analogous to that termed 'V-structure' by Eisenberg and Kauzmann (1969). The results manifest the expected enhancement in intermolecular interactions within the solvation shell, characteristic of higher orientational correlation, and this enhancement is markedly greater in the region which includes solvent that is shared by solute solvation shells. The V-structure obtained is consistent with an underlying network with further enhancement of intermolecular orientational correlations, upon which is superimposed thermal librational excitation. The intermolecular bonding is consistent with local energetic stabilization of the solvent-separated configuration, reinforcing the clathrate-like picture of solvation. (23 refs.)

118834 Monte Carlo computer simulation study of the hydrophobic effect—potential of mean force for $[(CH_4)_2]_{aq}$ at 25 and 50°C. G.Ravishanker, M.Mezei, D.L.Beveridge (Dept. of Chem., Hunter Coll., City Univ. of New York, New York, NY, USA).
Faraday Symp. Chem. Soc. (GB), no.17, p.79-91 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
A series of liquid state computer simulations has been performed on the system $[(CH_4)_2]_{aq}$ at 25°C as a function of the separation R between the dissolved CH_4 molecules. The potential functions for H_2O-H_2O, CH_4-H_2O and CH_4-CH_4 are based on quantum-mechanical calculations of the corresponding intermolecular interactions. The simulation was carried out by the Monte Carlo method augmented with convergence acceleration techniques involving force-bias and the method of preferential sampling. The potential of mean force $w_{ss}(R)$ for the interaction of the apolar species in water was determined using umbrella sampling procedures on four windows on the inter-solute coordinate. Convergence acceleration was found to be necessary for obtaining satisfactory results. Contact and solvent-separated contributions to the statistical state of the system are discussed in terms of the radial distribution functions, quasi-component distribution functions for coordination number, binding energy and pair interaction energies. Stereographic views of significant structures are presented, and contributions of clathrate structures in the solvent are discussed. The results are discussed in the context of the experimentally observed concentration dependence of hydrophobic effects and related theoretical work on $w_{ss}(R)$ by Marcelja, Mitchell, Ninham and Scully (1977), Pratt and Chandler (1977), and Pangali, Rao and Berne (1978). Prospects for quantitative study of the temperature dependence of the hydrophobic interaction and other quantitative extensions of the work are discussed. (26 refs.)

118835 Geometric relaxation in water: its role in hydrophobic hydration. R.Lumry, E.Battistel (Dept. of Chem., Univ. of Minnesota, Minneapolis, MN, USA), C.Jolicoeur.
Faraday Symp. Chem. Soc. (GB), no.17, p.93-108 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
The thermodynamic quantities $\Delta G°$, $\Delta H°$, $\Delta S°$ and $\Delta C_p°$ associated with the solvation of argon in water and aqueous mixtures are reinterpreted on the basis of two contributions. The first is related to the hydrogen-bonding connectivity of water and is assumed to be approximately represented by corresponding thermodynamic quantities in solvents such as hydrazine and ethylene glycol; following a proposal by Lumry and Frank (1978) and Lumry (1980), this contribution determines the free energy of hydrophobic hydration and is dominated by a positive enthalpy. The second contribution, which is responsible for marked enthalpy-entropy compensation and large heat-capacity effects

in argon hydration, is assigned to the characteristic fluctuation behaviour of liquid water. This assignment is substantiated by comparisons of the bulk properties of water and various other liquids, and a model is suggested to rationalize the uncommon thermodynamic properties of water, aqueous mixtures and solutions of hydrophobic solutes. The phenomenological representation proposed is an overlay of a randomly connected H-bond network and a local fluctuation process defined in terms of a minimum cooperative unit. This process, labelled 'geometric relaxation', is pictured as a cooperative H-bond rearrangement involving a water molecule coordinated by four neighbours. The limiting microstates of the cooperative units are 'short-bond' forms (with short, stiff, near-linear bonds) and 'long-bond' forms (with long, weak, bent hydrogen bonds). The first is dominated by the low enthalpy of short hydrogen bonds and the second by the high entropy resulting from motions of the water molecules on flexible hydrogen bonds into the free volume not available to the 'short-bond' form. (49 refs.)

118836 Application of the Kirkwood-Buff theory to the problem of hydrophobic interactions. A.Ben-Naim (Dept. of Phys. Chem., Hebrew Univ. of Jerusalem, Jerusalem, Israel).
Faraday Symp. Chem. Soc. (GB), no.17, p.121-7 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
Two possible applications of the Kirkwood-Buff (KB) theory of solutions to the problem of hydrophobic interactions (HI) are presented. The first involves the inversion of the KB theory and was published some years ago. Its main result, as far as HI is concerned, is the possibility of evaluating the integral G_{ss} for solute-solute interactions using experimental thermodynamical data. The second application is based on the exact relation which may be approximately factorized into two terms, one depending on the excluded volumes of the solutes and the other depending only on properties of the solvent. This relation enables one to estimate the strength of the HI and its dependence on the temperature and pressure. A preliminary set of results is presented. (8 refs.)

118837 The application of the HNC/MSA approximation to bulk electrolytes. D.Henderson (IBM Res. Lab., San Jose, CA, USA), M.Lozada-Cassou, L.Blum.
J. Chem. Phys. (USA), vol.79, no.6, p.3055-7 (15 Sept. 1983).
The HNC/MSA integral equation, where the hypernetted chain (HNC) kernel is replaced by the mean spherical approximation (MSA) kernel, is applied to a model bulk electrolyte consisting of charged hard spheres in a uniform dielectric medium. The thermodynamic functions which result from this hybrid integral equation are better than those of the HNC equation at low concentrations and only slightly worse than those of the HNC equation at high concentrations. At low concentrations, the HNC/MSA radial distribution functions are qualitatively better than the HNC values. In particular, there is no peak in $g_{++}(r)$ near $r=2\sigma$. Quantitatively, the HNC/MSA $g_{++}(r)$ appears to be an overcorrection of the HNC $g_{++}(r)$. (7 refs.)

118838 Extensions of the molecular dynamics simulation method. II. Isothermal systems. J.M.Haile, S.Gupta (Dept. of Chem. Engng., Clemson Univ., Clemson, SC, USA).
J. Chem. Phys. (USA), vol.79, no.6, p.3067-76 (15 Sept. 1983).
For pt.I see ibid., vol.73, p.2412 (1980). In this paper the authors systematically develop two general classes of equations of motion for performing molecular dynamics simulations at constant temperature. One member of each class is found to be identical to one of the two commonly used methods for performing such simulations. Of those two, one, namely the momentum scaling procedure, is proven to have no effect on the static properties of the simulated system. In addition, the authors have tested the two methods via equilibrium molecular dynamics on the Lennard-Jones fluid and find the resulting velocity autocorrelation functions and self-diffusion coefficients to be in good agreement with those determined by the standard NVE molecular dynamics method. (43 refs.)

118839 Numerical solution of RISM for homonuclear vibrating hard-dumbells. G.A.Chapela, S.E.Martinez-Casas (Dept. de Fisica, Univ. Autonoma Metropolitana-Iztapalapa, Mexico City, Mexico).
Mol. Phys. (GB), vol.50, no.1, p.129-37 (Sept. 1983).
Numerical solutions of the reference interaction site model (RISM) for site-site radial distribution functions $G_{\alpha\beta}(r)$ of a fluid of vibrating hard-dumbells are carried out, using a method of direct substitution in Fourier space. Comparisons with molecular dynamics (MD) results for the same system are given. The intramolecular distribution functions obtained by MD are used in RISM to obtain the corresponding intermolecular site-site $g_{\alpha\beta}(r)$, which in turn are compared against the MD results. These numerical results and further algebraic analysis indicate that the intermolecular site-site correlation functions calculated with RISM, do not depend noticeably on the form of the intramolecular correlation function used in the calculation. Additional evidence on the equivalence of vibrating and rigid hard dumbells is given. (12 refs.)

118840 Stokes-Maxwell relations for the distorted fluid microstructure. S.Hess (Inst. fur Theoretische Phys., Univ. Erlangen-Nurnberg, Erlangen, Germany), H.J.M.Hanley.
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.35-8 (3 Oct. 1983).
Relationships between the coefficients of the expansion of the pair correlation function for a fluid subjected to a shear are derived from a model kinetic equation. They equate a relaxation time with the viscosity and shear modulus of the fluid. Nonlinear phenomena are considered. The results are tested using nonequilibrium molecular dynamic simulation data for a soft sphere system close to freezing. Agreement between the theory and the simulations is satisfactory. (10 refs.)

118841 On the theory of coherent neutron and X-ray scattering from simple liquids. O.I.Gerasimov (Dept. of Theoretical Phys., Odessa State Univ., Odessa, USSR), V.Lisy.
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.60-2 (3 Oct. 1983).
A new relation between the cross section of X-ray coherent scattering and the structure factor (or the neutron scattering cross section) is obtained taking into account the electron density distortions of molecules in simple liquids. Some possible applications and generalizations of this relation are discussed. (8 refs.)

118842 Description of particle trajectories in classical Lennard-Jones liquids. C.S.Murthy, K.Singer (Dept. of Chem., Royal Holloway Coll., Egham, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1797, p.299-317 (8 Oct. 1983).
The trajectories of single particles in a simple Lennard-Jones liquid show no regularities that facilitate an intuitively meaningful description. An analysis of the statistics of quasi-oscillations of the cartesian coordinates and of successive right-angle turns of the trajectories is attempted. Simple stochastic processes based on these characteristics lead to reasonable approximations to the self-diffusion constant. Other features discussed include fluctuations in kinetic, potential and total energy, the shape of the local potential field and the curvature of the trajectories. (10 refs.)

Hydrophobic interactions—a historical perspective ....See Entry 116946

Thermodynamics of cavity formation in water: a molecular dynamics study ....See Entry 118847

Computer simulation of the dynamics of optically active molecules in the liquid state ....See Entry 118852

The effect of pressure on the structure of light and heavy water ....See Entry 118856

The structure of liquid benzene ....See Entry 118858

On density profiles of ionic systems near a charged hard wall ....See Entry 119380

61.25 STUDIES OF SPECIFIC LIQUID STRUCTURES

(see also 61.40 Amorphous and polymeric materials)

118843 On the structure factor of metal-molten salt solutions. J.Wiechen, F.Brouers (Inst. of Theoretical Phys., Freie Univ. Berlin, Berlin, Germany).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.387-8 (16 Sept. 1983).
The authors show that in contrast to MSA the HNC approximation can account qualitatively for the long wavelength scattering of metal-molten salt solutions. The difference is attributed to the defects of the MSA in the description of the short-range as well as the long-range order in the liquid. (5 refs.)

118844 Structural determination of a molten (Li-K)Cl mixture of the eutectic composition by X-ray diffraction and molecular dynamics simulation. I.Okada, H.Okano, H.Ohtaki, R.Takagi (Dept. of Electronic Chem., Tokyo Inst. of Technol., Yokohama, Japan).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.436-41 (23 Sept. 1983).
X-ray diffraction was performed for a molten (Li-K)Cl mixture of the eutectic composition at 668K. The three dimensional structure of the melt was determined with the aid of molecular dynamics simulation. (23 refs.)

118845 The pair-correlation functions of water at a pressure of 1000 bar in the temperature range 25-500°C. Yu.E.Gorbaty, Yu.N.Demianets (Inst. of Experimental Mineralogy, Acad. of Sci., Moscow, USSR).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.450-4 (23 Sept. 1983).
Pair-correlation functions for liquid and supercritical water are reported. The behaviour of these functions shows a lessening of the hydrogen bonding and the tetrahedral ordering in the water structure with increasing temperature. Strong evidence that the distribution of intermolecular distances between nearest-neighbour molecules should be discrete is found. The contributions of structurally distinguishable molecules to the coordination number of water are estimated. (17 refs.)

118846 Evidence for inhomogeneities in polyethylene melts as detected by n.m.r. transverse relaxation and free induction. R.Bachus, R.Kimmich (Univ. Ulm, Ulm, Germany).
Polym. Commun. (GB), vol.24, no.10, p.317-20 (Oct. 1983).
Internal substance inhomogeneities leading to a broadening of the proton magnetic resonance linewidth by up to two orders of magnitude have been found with diverse fractions of linear polyethylene in the molten state. This effect can be explained by changes in the magnetic susceptibility due to density inhomogeneities. Fluctuations of the inhomogeneities and diffusive displacements of the observed nuclei lead to partial motional averaging. The molecular weight, frequency and matrix dependences have been studied. (10 refs.)

118847 Thermodynamics of cavity formation in water: a molecular dynamics study. J.P.M.Postma, H.J.C.Berendsen, J.R.Haak (Lab. of Phys. Chem., Univ. of Groningen, Groningen, Netherlands).
Faraday Symp. Chem. Soc. (GB), no.17, p.55-67 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
Thermodynamic quantities related to the solvation of hydrophobic solutes in water can be approximated by the application of scaled particle theory. The crucial quantity is the Gibbs free energy of cavity formation. A series of six molecular dynamics simulations of water including repulsive cavities of various sizes has been carried out. Using perturbation statistical mechanics, the free energy has been derived as a function of cavity radius up to 0.32 nm (0.32 nm approach of water oxygens to the cavity centre). The free energy agrees well with predictions from scaled particle theory and the experimental surface tension is predicted to within 5%. The radial distribution of water molecules with respect to the cavity has been determined for five cavity sizes; for one size (radius of approach of water oxygens of 0.3 nm) the orientational distribution and the residence time distribution in the hydration shells has been determined. (23 refs.)

118848 Hydrophobic interactions in dilute solutions of poly(vinyl alcohol). D.Eagland, N.J.Crowther (School of Pharmaceutical Chem., Univ. of Bradford, Bradford, England).
Faraday Symp. Chem. Soc. (GB), no.17, p.141-60 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
High-precision density and light-scattering measurements in water and 10^{-3} mol dm^{-3} electrolyte solutions of samples of 80 and 90% poly(vinyl alcohol) (PvOH) over an extended range of concentration and temperature have revealed a complex pattern of solution behaviour; the report is restricted to the behaviour of solutions at concentrations below 0.15% w/v. Partial molal volume ($\bar{V}_2°$) and expansibility ($\bar{E}_2°$) studies at infinite dilutions in water show the existence of a very strong temperature dependence in these partial molal properties; $\bar{E}_2°$ studies suggest that increasing hydrophobic hydration occurs between 10 and 15°C, which results in a rapid conformational change in the molecule between 15 and 18°C, producing a structure which is predominantly hydrated in the hydrophilic sense. At temperatures above 18°C gradual erosion of this hydration appears to take place. Corresponding studies on a sample of 90% hydrolysed PvOH show broadly similar behaviour, but modified by the presence of a smaller proportion of hydrophobic vinyl acetate groups; for example, the conformation change with temperature is not as abrupt as in the case of 80% hydrolysed PvOH. Similar studies in 10^{-3} mol dm^{-3} solutions of LiCl, Li_2SO_4, NaCl and KCl illustrate the large ionic effects upon the hydrophobically dictated conformational change; these effects compare remarkably well with the calculated thermodynamic property changes, associated with salt effects, in the folding process of the globular protein ribonuclease. Particle size and second virial coefficient values obtained from light-scattering studies confirm the behaviour pattern observed. (34 refs.)

118849 Conformational and functional properties of haemoglobin in water+alcohol mixtures. Dependence of bulk electrostatic and hydrophobic interactions upon pH and KCl concentration. L.Cordone, A.Cupane, F.D'Alia, M.G.De Stefano (Istituto di Fisica, Univ. di Palermo, Palermo, Italy).
Faraday Symp. Chem. Soc. (GB), no.17, p.161-74 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
The reaction of haemoglobin with oxygen in the presence of some monohydric alcohols has been studied at various KCl concentrations and pH values. The analysis of the results followed a previously described approach allowing: (1) the determination of the effects of cosolvents on the free-energy difference between T and R states of haemoglobin and (2) the separation of these effects into contributions linearly related to the variation of the inverse bulk dielectric constant of the water+cosolvent mixture (bulk-electrostatic contributions) and contributions that are ascribed to the variation of protein-solvent hydrophobic interactions (non-bulk-electrostatic contributions). Bulk-electrostatic contributions were found to depend on pH and salt concentration. Non-bulk-electrostatic contributions were also found to increase with increasing pH and salt concentration. Linear correlations, not dependent upon the particular alcohol, were found to connect the non-bulk-electrostatic contributions obtained at different KCl concentrations or pH values. (20 refs.)

118850 Cooperative hydrogen bonding and structural instability in water. J.Leblond (Ecole Superieure de Phys. et Chimie Industrielles, Paris, France).
J. Phys. (France), vol.44, no.10, p.1201-8 (Oct. 1983).
The author proposes a model for liquid water in which the bonding states of each molecule are represented by a 5-level equivalent system. The structural effects are taken into account in a theoretical approach of the 'meanfield' type, the mean-field (internal pressure) being supposed to decrease when the number of 4-bonded molecules increases. The model predicts the dependence of several thermodynamical parameters on T and P, and the existence of a structural stability limit which implies a divergence of α_p, β_T and C_P in the supercooled state. The existence of a structural critical point is discussed. (28 refs.)

118851 Packing and conformational contributions in binary liquid mixtures: acoustic studies of n-hexadecane with dimethylpentanes. A.M.Awwad, A.M.North, R.A.Pethrick (Dept. of Pure & Appl. Chem., Univ. of Strathclyde, Glasgow, Scotland).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.10, p.2333-41 (Oct. 1983).
In order to separate internal (rotational isomeric) and external (intermolecular structural) contributions to volume effects in liquid alkane mixtures, ultrasonic attenuation and velocity measurements have been made on hexadecane and its mixtures with dimethylpentane. Within experimental error the rotational isomeric contribution is a simple sum of those of the pure components. However, the shear and volume viscosity contributions are not linearly additive, but show a negative excess quantity. This is explained on the basis of a structural equilibrium between more ordered (solid-like) and less ordered (more liquid-like) regions in the liquid mixture. The results indicate that there is a geometrical packing component in the mixture interaction parameter, χ_{12}. (35 refs.)

118852 Computer simulation of the dynamics of optically active molecules in the liquid state. M.W.Evans (Edward Davies Chem. Labs., Univ. Coll. of Wales, Aberystwyth, Wales).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1331-40 (Sept. 1983).
The technique of computer simulation is used to produce detailed information on the molecular dynamics of *R*- and *S*-1,1-chlorofluoroethane and the racemic mixture. A critically important difference in the dynamical behaviour of the two enantiomers is revealed using a rotating frame of reference. This is the source of observable differences in laboratory frame auto-correlation functions of the racemic mixture and therefore in measurable liquid phase spectra. Therefore, by measuring the spectrum of either enantiomer, followed by that of their racemic mixture, information is provided directly on the statistical correlation between a molecule's rotation and centre-of-mass translation. The author believes this to be a new explanation for a well known phenomenon of the molecular liquid and solid states of matter. (23 refs.)

118853 An encapsulated dumbbell model for concentrated polymer solutions and melts. I. Theoretical development and constitutive equation. R.B.Bird, J.R.Deaguiar (Chem. Engng. Dept., Univ. of Wisconsin, Madison, WI, USA).
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.2, p.149-60 (Sept. 1983).
The finitely extensible nonlinear elastic (FENE) dumbbell model used earlier for dilute polymer solutions may also be used for concentrated solutions and melts if the Brownian motion and hydrodynamic forces acting on the beads are made nonisotropic. This corresponds roughly to imagining that a dumbbell is constrained to move within a capsule-shaped region embedded in the surrounded fluid. The constitutive equation obtained (a modified convected Maxwell model) contains four parameters: σ and β specify the extent of anisotropy in Stokes' law and in the Brownian motion forces respectively; λ is a time constant; and b describes the finite extensibility of the dumbbell. When σ and β are set equal to unity, the dilute-solution constitutive equation is recovered. In this sense the molecular theory permits a description of polymeric liquids over the entire concentration range. (16 refs.)

118854 An encapsulated dumbbell model for concentrated polymer solutions and melts. II. Calculation of material functions and experimental comparisons. J.R.Deaguiar (Chem. Engng. Dept., Univ. of Wisconsin, Madison, WI, USA).
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.2, p.161-79 (Sept. 1983).
For pt.I see ibid., vol.13, no.2, p.149 (1983). The constitutive equation derived in Part I is used to compute steady-state and time-dependent material functions. A procedure is suggested for determining the four independent model parameters (λ_H, b, σ, β) from experimental data. Material functions have been calculated using parameters determined by experimental data for concentrated solutions of nearly monodisperse linear polymers. The theoretical curves for steady shear properties (η and Ψ_1) are in quantitative agreement with the data well into the range of nonlinear behavior. The calculated time-dependent properties (η^*, η^+, Ψ^+, η^-) are in qualitative agreement with observed behavior. Theoretical curves for elongational viscosity are reasonable, but suitable experimental data are not available for comparison. (3 refs.)

118855 A RISM analysis of structural data for tetrahedral molecular systems. D.G.Montague, M.R.Chowdhury, J.C.Dore, J.Reed (Phys. Lab., Univ. of Kent, Canterbury, England).
Mol. Phys. (GB), vol.50, no.1, p.1-23 (Sept. 1983).
A systematic study has been made of available X-ray and neutron diffraction data for liquids and amorphous solids composed of tetrahedral molecules. The intermolecular function, $D_M(Q)$, has been compared with predictions computed by the reference interaction site model (RISM) in order to determine the effective hard core radii which characterize the molecular contours. It is found that the RISM formulation gives a satisfactory first-order representation of the data in most cases but there are significant discrepancies which prevent the model being used to give a detailed quantitative description. Specific features are noted in the case of P_4 and As_4 systems which suggest that a central auxiliary site is required to give agreement with the experimental results. The geometrical packing is considered in relation to orientational correlations between adjacent molecules and the systematic behaviour examined for a range of materials. (27 refs.)

118856 The effect of pressure on the structure of light and heavy water. G.A.Gaballa, G.W.Neilson (H.H. Wills Phys. Lab., Univ. of Bristol, Bristol, England).
Mol. Phys. (GB), vol.50, no.1, p.97-111 (Sept. 1983).
X-ray diffraction experiments were carried out on light and heavy water to pressures of 6 kbar. The results are in qualitative agreement with the molecular dynamics studies of Impey, Klein and McDonald (1981). However, there are appreciable quantitative differences. The intramolecular O-H and O-D linewidths exhibit a different dependence on pressure, and this is interpreted in terms of the differing dynamical properties of the two liquids. The nearest neighbour intermolecular hydrogen bonding O-H correlation is at a separation of $\sim$2.0 Å and there is a 15 per cent increase of coordination number over the pressure range of investigation. For pressures of 1 bar and 5 kbar the nearest neighbour oxygen-oxygen separation changes from 2.89 Å to 2.84 Å in light water and from 2.89 Å to 2.84 Å in heavy water. This result is a factor of 6 larger than that predicted by molecular dynamics and about a factor of 3 less than that inferred from NMR studies. There is also an increase in coordination number of about 10 per cent. Other longer range O-O correlations are observed and a qualitative explanation of their pressure dependence is presented. (28 refs.)

118857 Rayleigh light scattering by liquids composed on interacting anisotropic molecules—spherical tensor approach within the second order approximation of the DID model. T.Bancewicz (Inst. of Phys., A. Mickiewicz Univ., Poznan, Poland).
Mol. Phys. (GB), vol.50, no.1, p.173-91 (Sept. 1983).
By methods of spherical tensor algebra and applying the dipole-induced dipole (DID) model, a general expression is derived with accuracy to within the second order of statistical perturbation theory for the effective polarizability and Rayleigh-scattered light intensity for liquids composed of unlike anisotropic molecules. The results have permitted the application of a computer simulated binary distribution function to calculate the scattered light intensity. The roles of various contributions to the integral intensity are discussed. Numerical calculations are performed for liquid Br_2 and N_2 pointing to an essential role of angular-radial correlations and cross terms. The general expressions are shown to simplify easily in the particular case of radially but not angularly correlated molecules. (39 refs.)

118858 The structure of liquid benzene. M.Claessens, M.Ferrario, J.-P.Ryckaert (Univ. Libre de Bruxelles, Bruxelles, Belgium).
Mol. Phys. (GB), vol.50, no.1, p.217-27 (Sept. 1983).
Molecular dynamics simulation of liquid benzene is exploited to test the degree of sensitivity of the local structure to the intermolecular potential. Three effective potential models (based on a six Lennard-Jones centres potential) are investigated. The usually admitted picture of a liquid with quasi-crystalline short range molecular arrangement is shown to be very doubtful. Analysis of the crystalline structure predicted by the different interaction potentials indicates a manifest superiority of the only model including a point quadrupole at the centre of the benzene ring. (18 refs.)

118859 Universality for static properties of polystyrenes in good and marginal solvents. P.Wiltzius, H.R.Haller, D.S.Cannell (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA), D.W.Schaefer.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1183-6 (26 Sept. 1983).
Reports the first experimental evidence that solutions of linear flexible polymers are characterized by a concentration-dependent universal length which is easily scaled to be independent of molecular weight $M(3\times10^5\leq M\leq2.6\times10^7)$ and of solvent quality. It is also found that the product of M and the derivative of the osmotic pressure π with respect to concentration c, $M(\partial\pi/\partial c)_T$, is universal and independent of solvent quality of M. (18 refs.)

118860 Local concentration of units and molecular mobility in swelled polymer networks. Yu.Ya.Gotlib, I.A.Torchinskii.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.9, p.1830-7 (Sept. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The local concentration of units in the crosslinked network has been evaluated using the Gaussian subchain model. The dependences of local concentration of units on disposition of the studied site of the network, on the density of crosslinking, and on degree of swelling are derived. The local concentration of the network is compared with the concentration of free branches and non-branched macromolecules in concentrated solutions (for the same concentration of a polymer). The effects of heterogeneity of real networks are discussed as well as their role in a decrease of mobility with increasing of the density of crosslinking observed in swelled PS networks by NMR method. (17 refs.)

118861 Light scattering of solutions of polyamidohydrazide and conformational characteristics of its molecules. V.N.Tsvetkov, S.O.Tsepelevich.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.9, p.1906-13 (Sept. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The results of measuring of light scattering in solutions of 18 samples of polyamidohydrazide (PAH) in DMSO in more than 10-fold range of MM values are presented. Excluded volume effects do not affect essentially the dimensions of PAH molecules in solution. From the experimentally found MM and gyration radii the value of Kuhn segment is evaluated being equal to $A=240\times10^{-10}$ m. From the viscometry data $A=200\times10^{-10}$ m and the value of the hydrodynamic cross-section $d=5\times10^{-10}$ m. According to the data obtained PAH is a typical rigid polymer. Uncoiled conformation of its molecules is related with high rigidity of the chain, but not with the effect of excluded volume. (30 refs.)

Infrared and nuclear magnetic resonance studies pertaining to the cage model for solutions of acetone in water .... See Entry 117867

The application of the HNC/MSA approximation to bulk electrolytes .... See Entry 118837

Chemical n-doping of polyacetylene .... See Entry 118904

Free volume and internal pressure of liquid mixtures from ultrasonic velocity of different temperatures .... See Entry 119103

Existence of a novel liquid phase in methyl acetate .... See Entry 119169

LCST behaviour in blends of PMMA with PVC .... See Entry 119203

Viscosity and longest relaxation time of semi-dilute polymer solutions. I. Good solvent .... See Entry 119249

Thermodynamic theory of the surface tension of liquids in homogeneous series of linear-chain molecules .... See Entry 119304

Soluble polyacetylene .... See Entry 120297

Selective solvation of polystyrene in tetralin/cyclohexane mixtures ....See Entry 120620

Features of structure formation during vibration of aqueous solutions of clays ....See Entry 120679

61.25M Liquid metals

Shear viscosity in rapidly quenched states ....See Entry 119250

Survey of extant data for the surface tension of iron and its binary alloys ....See Entry 119314

Effect of conditions for producing amorphous metallic films of hypereutectic iron-boron alloy on their structure ....See Entry 119377

61.30 LIQUID CRYSTALS

(see also 64.70M Transitions in liquid crystals)

118862 On the existence of micellar positional correlations in a type I nematic lyomesophase: an X-ray diffraction experiment. A.M.Figueiredo Neto, L.Q.Amaral (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.651-8 (1 Sept. 1983).
The nematic type I lyomesophase of K laurate/KCl/water is studied by X-ray diffraction and optical microscopy. X-ray diffraction patterns of samples in very thin capillaries and chemically surface-treated capillaries indicate the existence of a hexagonal array of cylindrical micelles. In normal conditions, where only one oriented band is observed, it is possible to describe the lyomesophase structure as nematic. An analysis of the band width is made by comparing the experimental scattering curves with theoretical expressions obtained from different models. This analysis indicates that micellar positional correlations have to be introduced to explain the experimental results. (35 refs.)

118863 Exact solutions for liquid crystal configurations and an improved boundary layer model. R.N.Thurston (Bell Telephone Labs., Holmdel, NJ, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.4966-88 (Sept. 1983).
The director configuration in a liquid crystal cell is basic to an understanding of both the optical contrast between states and switching dynamics. This paper treats the voltage dependence of nematic liquid crystal configurations in which the director orientation depends on a single space coordinate z, and there are equal but oppositely tilted boundary conditions on the two cell surfaces at $z=\pm d/2$. In the boundary layer model, configurations are approximated by joining together pieces of 'boundary layer solutions', which are solutions of the equations for equilibrium configurations in a half space with the boundary condition θ=constant at only one surface and $\theta=d\theta/dz=0$ at $z=\infty$, where θ is measured from the normal to the surface. This paper (1) indicates exact solutions that satisfy the cell boundary conditions, (2) examines their high voltage asymptotes, (3) proves that the boundary layer solutions reproduce the essential features of these asymptotes, and (4) presents a way of fitting boundary layer solutions into a finite cell by joining them where $\theta=\theta_{\min}$ such that $\theta_{\min}$ is the correct asymptotic function of voltage. Topologically distinct horizontal (H) and vertical (V) states are distinguished by the boundary conditions: if $\theta=\theta_b$ at one surface, then at the other surface $\theta=-\theta_b$ for V and $\pi-\theta_b$ for H. The H state can be symmetric (H_S) or asymmetric (H_A). All of these states are treated, with emphasis on the high voltage asymptotic behavior. Below the H_A-H_S threshold, H_A is nonexistent, and H_S is stable; above this threshold, H_A is stable and H_S is unstable [Julian Cheng, R.N. Thurston, and D.W. Berreman, J. Appl. Phys. 52, 2756 (1981)]. (38 refs.)

118864 The rotational viscosity of nematic liquid crystal mixtures at low temperatures. H.Schad (Brown Boveri Res. Center, Baden, Switzerland).
J. Appl. Phys. (USA), vol.54, no.9, p.4994-7 (Sept. 1983).
An experimental setup is described for the determination of the rotational viscosity γ_1 of nematic liquid crystals which operates at temperatures down to $-60°C$. Using this setup the author has determined γ_1 of several liquid crystal mixtures over a wide temperature range and finds significant deviations from Arrhenius behavior at lower temperatures. (13 refs.)

118865 On cooperative modes of reorientation in liquid crystals. G.P.Zientara, J.H.Freed (Baker Lab. of Chem., Cornell Univ., Ithaca, NY, USA).
J. Chem. Phys. (USA), vol.79, no.6, p.3077-89 (15 Sept. 1983).
The role of cooperative modes of reorientation in liquid crystals for the spectral densities of importance in magnetic resonance relaxation is examined from the viewpoint of microscopic models that can be solved analytically. These include linear arrays of rods in an applied external field whose orientations are strongly coupled and whose motion is described by overdamped and coupled diffusion equations. Also considered are Cayley-tree models, which, at least for nearest neighbors, can mimic higher dimensions than one. All these models lead to the result that the qth normal mode of relaxation has a decay rate that depends upon q as $\sin^2(qa/2)$, where a is the lattice spacing. Using simple scaling, it is argued that if a is replaced by $a'\equiv La$, so the authors' model consists of blocks of L rodlike molecules with renormalized parameters, then molecular detail becomes less important and the model arrays become more physically representative. These results are then utilized to extend the standard hydrodynamic theory for long wave vectors q to short wave vectors approaching molecular dimension. The spectral densities obey scaling (i.e. are nearly independent of a') and are nearly identical to the hydrodynamic result for lower frequencies. However, the new results do show small departures at the higher frequencies usually studied by NMR. (35 refs.)

118866 The first bilayer ferroelectric liquid crystal. H.R.Brand (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA), P.E.Cladis, P.L.Finn.
J. Phys. Lett. (France), vol.44, no.18, p.L771-6 (15 Sept. 1983).
The authors have found the first chiral smectic C liquid crystal formed by strongly bound anti-parallel pairs of molecules. The director of the new phase, which has a net permanent polarization, can be oriented in an electric field in a way similar to a chiral C phase formed by monomers. (14 refs.)

118867 Flow-alignment and the sign of κ_2 in nematic liquid crystals. W.W.Beens, W.H.de Jeu (Solid State Phys. Lab., Univ. of Groningen, Groningen, Netherlands).
J. Phys. Lett. (France), vol.44, no.19, p.L805-9 (1 Oct. 1983).
Results are presented for the flow-alignment angle θ_0 of various nematics. Measurements for two compounds that differ mainly in the presence of a strongly polar terminal cyano-group indicate that this has no influence on θ_0. Results for a homologous series give a decrease of θ_0 with increasing alkyl chain lengths, until finally no flow-alignment exists due to a change in sign of κ_2. This is attributed to pretransitional smectic order. (10 refs.)

118868 Conformational flexoelectricity in nematic liquid crystals. I.Dozov, P.Martinot-Lagarde, G.Durand (Lab. de Phys. des Solides, Univ. de Paris-Sud, Orsay, France).
J. Phys. Lett. (France), vol.44, no.19, p.L817-22 (1 Oct. 1983).
Using the direct flexoelectric effect in an hybrid (homeotropic-planar) nematic cell, the authors have measured the bulk flexoelectric coefficient e^* for two cyanobiphenyl compounds. ICB and 8OCB. For 8CB, the flexo coefficient is comparable in sign and magnitude with that of MBBA, i.e. $e^*\sim+10^{-4}$ cgs. 8OCB presents an anomalously large and negative $e^*\sim-5\times10^{-4}$ cgs. The small influence of the cyano group can be explained by molecular pairing. The large effect from the oxygen is interpretated by a coupling between the macroscopic bend distortion and conformations of the alkoxy chains, i.e. as conformational (dipolar) flexoelectricity. The temperature dependence of e^* shows an unexpected proportionality to the nematic order parameter S. This may be related to the steric constraint, from the rigid rod cores, on the entropy of the alkoxychains. (10 refs.)

118869 Nature of the mesophase of a conducting charge transfer complex: neither discotic nor calamitic. P.Davidson, A.M.Levelut (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France), H.Strzelecka, V.Gionis.
J. Phys. Lett. (France), vol.44, no.19, p.L823-8 (1 Oct. 1983).
The authors describe the structure of the mesophase of a conducting charge transfer complex formed by a donor substituted by four long paraffinic chains and TCNQ as acceptor. In the mesophase the donor cores remain in stacks with a short core-to-core distance (3.6 Å). The presence of paraffinic chains favours a layer structure, the stacks being localized in the lamellae and TCNQ likely filling the space between stacks. Therefore the organization in this mesophase is intermediate between those of smectic and columnar discotic liquid crystals. (13 refs.)

118870 The cholesteric blue phase: a progress report. P.P.Crooker (Dept. of Phys. & Astron., Univ. of Hawaii, Honolulu, HI, USA).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.31-45 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Experimental studies of the blue phase of cholesteric liquid crystals have revealed two cubic phases (BPI and BPII) and a possible amorphous 'fog' phase (BPIII). In addition, a number of theoretical models have been proposed which arrive at these structures from the point of view of a Landau theory, a lattice of disclinations, or as an ordered emulsion. The author reviews the present state of knowledge of the blue phase and show the significance of blue phase studies to other problems in condensed matter research. (22 refs.)

118871 Molecular reorientation in liquid crystals. J.A.Janik (Inst. of Nuclear Phys., Krakow, Poland), M.Godlewska, T.Grochulski, A.Kocot, E.Sciesinska, J.Sciesinski, W.Witko.
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.67-81 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The results of quasielastic neutron scattering (QNS) experiments for nematic and smectic liquid crystals performed in different laboratories are reviewed and compared with results of dielectric relaxation studies. The fIR spectra for PAA and HOAB in the frequency range of 20-200 cm^{-1} are presented. $\alpha(\bar{\nu})$ values for the nematic and isotropic phases in the whole frequency range including the microwave and submillimeter regions are discussed in terms of the two-time model for molecular librations in the potential cage (confined rotator model). The model fits very well all the experimental data obtained from microwave, carcinotron and fIR techniques. Additionally it may explain the discrepancy between QNS and dielectric relaxation correlation times. (4 refs.)

118872 Liquid crystal orientation on inorganic surfaces. T.Uchida, M.Ohgawara, Y.Shibata (Dept. of Electronic Engng., Faculty of Engng. Tohoku Univ., Sendai, Japan).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.149-61 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
It has been known empirically that some kinds of liquid crystal align perpendicular to inorganic flat surface such as In_2O_3 film. The authors evaluate the adsorbabilities of various amphiphilic materials to inorganic surfaces by using a chromatographic effect and investigate the correlation between the adsorbability and the liquid crystal orientation. From the results, it is found that the perpendicular alignment of liquid crystal is induced when polarities of the amphiphilic material and substrate surface are both strong. It is also found that there is evident relation between the polarity and IEPS (Isoelectric Point of Solid Surface) which is a measure of basicity of the surface. This fact suggests that adsorption of the amphiphilic impurity to the surface is due to the acid-base interaction. (17 refs.)

118873 Electrohydrodynamic behavior in twisted-wedge nematic structures. J.A.Martin-Pereda, M.A.Muriel, F.J.Lopez (Dept. de Electronica Cuantica, Univ. Politecnica de Madrid, Madrid, Spain).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.183-91 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
A new type of domain for nematic liquid crystals with a twisted-wedge structure is presented. This new type of domain appears from the low frequency range to 10 kHz. This behavior was observed for square and pulsed excitations. The liquid crystal was N-(*p*-methoxybenzylidene-p'-butylaniline) (MBBA) used at room temperature. These domains offer a higher degree of complexity than conventional Williams domains. The corresponding stability chart is presented. (10 refs.)

118874 Study of S_A phase structure using dielectric relaxation. C.Druon, J.M.Wacrenier (Univ. de Lille, Villeneuve D'Ascq, France).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.201-8 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The results of a study of dielectric relaxation for several mesomorphous substances are presented. These compounds allow us to obtain information on the following phases: the nematic phase—partially bilayer (S_{Ad}), bilayer (S_{A2}) and monolayer (S_{A1}) smectic A phases—the antiphase smectic A ($S_{\tilde{A}}$). The measurements were performed with the electric field parallel to the director. The absorption observed is due to the reorientation motion of the molecule round an axis perpendicular to its longitudinal axis. The activation energy W of this movement was measured for all phases. Results show clearly that for these compounds $W_{SAd}<W_N$, $W_{SA1}\sim W_N\sim W_{S\tilde{A}}$ and $W_{SA2}>W_N$. In each case an explanation has been suggested to interpret these changes in the activation energy. This points out the possibility of showing the existence of some S_A phases using dielectric relaxation. (13 refs.)

118875 The cholesteric pitch in lyotropic solutions of a semi-rigid macromolecule: hydroxypropyl-cellulose. F.Fried, J.M.Gilli, P.Sixou (Lab. de Phys. de la Matiere Condensee, Univ. de Nice, Nice, France).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.209-21 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The cholesteric pitch P of lyotropic mesophases of hydroxypropyl-cellulose are determined from optical measurements, i.e. angular dependence of the scattered light intensity and transmission spectra. The observed results are explained with help of Pincus' theory (1968) for cholesteric liquid crystals. The variations of the twisting power with physical parameters such as polymer concentration C, nature of solvent, molecular weight, and ageing are investigated. The power law $P=P_0C^{-\alpha}$ is well satisfied for all polymer solvent combinations. It is proposed that the solvent could influence the cholesteric pitch not only through its intrinsic properties, but also through modifications of the macromolecular characteristics themselves. (32 refs.)

118876 McMillan theory of binary smectic mixtures. W.Wagner (Zentralinst. fur Elektronenphys., Akad. der Wissenschaften, Berlin, Germany).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.247-55 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The molecular field theory of the smectic A phase, developed by McMillan (1971), is extended to binary smectic mixtures. Expressions for the orientation-dependent mean field potential of each component are derived. Besides the interaction terms of the pure components, two additional parameters appear. These mixed parameters describe the interaction forces between particles of different species. The composition dependences of the transition temperatures are determined from the free energies. The possible existence of a two-phase region is neglected. By suitable choices of the interaction parameter set, it is possible to predict induced phases. If all interaction parameters satisfy the geometric mean rule, the mixture will be an ideal one, exhibiting linear phase transition lines. Because of the coupling between the smectic order and the nematic order, the transition lines of both phases are correlated. By fitting an experimental phase diagram one is able to determine the unknown values of the mixed interaction parameters. (10 refs.)

118877 The crystal and molecular structure of a reentrant nematogen: 4-cyanophenyl-3-methyl-4′-(4″-n-undecyloxy cinnamoyloxy)benzoate (11 CPMCB). G.V.Vani (Raman Res. Inst., Bangalore, India).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.275-84 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The crystal and molecular structure of 4-cyanophenyl-3-methyl-4′-(4″-n-undecyloxycinnamoyloxy)benzoate (11 CPMCB), $C_{35}H_{39}O_5N$, has been determined at room temperature by direct methods. The compound, which exhibits a reentrant nematic phase, crystallizes in the triclinic space group $P\bar{1}$, $a=10.368$, $b=10.846$, $c=16.750$ Å, $\alpha=97.90$, $\beta=100.28$, $\gamma=118.68°$, with two molecules in the unit cell. The structure has been refined to $R=0.106$, using photographically observed data. The 11 CPMCB molecules pack in a well-imbricated antiparallel arrangement with their alkoxy chains fully extended. The molecular packing in the crystal is discussed with reference to the reentrant behavior of the compound. (11 refs.)

118878 Orientational order of spin probe molecules in liquid crystals. S.K.Ghosh, A.Panatta (Univ. dell'Aquila, L'Aquila, Italy), A.Ricchiuto, P.L.Indovina.
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.349-59 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Reports measurements of hyperfine splittings and g-values of two nitroxide spin probes 4′4′-dimethyl-spiro-(5α-cholestane-3,2-oxazolidin)-3′-yloxyl and 2-(10-carboxydecyl)-2-hexyl-4,4-dimethyl-3-oxazolidinyloxyl methyl ester dissolved in p-azoxyanisole. Using the principal axes values of $\mathbf{g}$ and $\mathbf{A}$ tensors available, the authors have determined all three diagonal components of the orientation order parameter tensor $\mathbf{S}$ for these spin probe molecules. For neither of the spin probes used has this tensor $\mathbf{S}$ the cylindrical symmetry that is normally assumed to determine the orientational order parameter tensor $\mathbf{S}^{(p)}$ defined by the long molecular axis from such measurements. This conclusion about $\mathbf{S}$ is independent of any uncertainty in the principal axes values of the $\mathbf{g}$ and $\mathbf{A}$ tensors, and hence the relations between $\mathbf{S}$ and $\mathbf{S}^{(p)}$ normally used do not seem to be well justified. Probable relations are also suggested. (13 refs.)

118879 Importance of steric effects in the isotropic phase of nematogenic compounds. J.P.Parneix, C.Legrand, D.Decoster (Univ. des Sci. et Tech. de Lille 1, Villeneuve d'Ascq. France).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.361-74 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The dielectric spectra of some mesomorphic substances in their isotropic phase are reported. The measurements are carried out from the radio frequencies up to the far infrared region. The authors have investigated several substances such as azoxybenzenes, cyanophenylcyclohexanes, azomethines, tolanes and biphenyls. Two special cases appear with the last two series where the dipole moment is directed either perpendicular or parallel to the long molecular axis respectively. The dielectric spectra show different absorption connected with rotational movements around or perpendicular to the long axis. The influence of the molecular surrounding on the dielectric properties is also studied by investigating the influence of dilution. The results have been discussed by using a computer simulation of molecular dynamics of fluid systems containing ellipsoidal particles which interact pair-wisely, assuming the interactions to be governed mainly by steric effects. (6 refs.)

118880 Orientational order of long-chain molecules in the nematic phase. S.K.Ghosh (Univ. of dell'Aquila, L'Aquila, Italy).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.375-84 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
It is shown that the quadrupole splittings arising from the different deuterium sites of long-chain molecules constituting nematic liquid crystal phase can be well understood with a single order parameter tensor $\mathbf{S}$ defined for the whole molecule by its long molecular axis, as has been suggested elsewhere. This is demonstrated explicitly for p-cyanobenzylidene-p'-d_{17}-octyloxyaniline and p-butyloxybenzylidene-p'-d_{17}-octyl-2,6-d_2-aniline. The role of molecular conformations in relation to the observed splittings has been made evident by recovering the average quadrupole coupling constants and orientations of different C-D bonds for both molecules. These values are in reasonable agreement. (15 refs.)

118881 Novel liquid crystalline derivatives of cubanes and hydrogenolyzed cubanes. G.W.Gray, N.A.Langley, K.J.Toyne (Dept. of Chem., Univ. of Hull, Hull, England).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.425-31 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The N-I transition temperatures for a range of 4-propyl 1-monoesters and several 1,4-diesters of cubane, bicyclo(2.2.2)octane, cyclohexane and benzene have been determined. The differences between the values for the monoesters and diesters of each system and between those for the various ring systems for the mono- and di-ester series are discussed. Cubane has a very poor ability to generate nematic phases of high thermal stability, and the relative nematic stability of the benzene derivatives are significantly different in the series, the diesters with a central benzene ring having the highest N-I transition temperatures. The values for diesters and monoesters of dihydrocubane are compared with those for cubanes and the effect of deviations from colinearity of the substituent bonds of changes in flexibility are discussed. (5 refs.)

118882 Regulation of heat transfer using liquid crystals in the presence of electric fields. E.F.Carr (Dept. of Phys., Univ. of Maine, Orono, ME, USA).
Mol. Cryst. & Liq. Cryst. Lett. (GB), vol.92, no.6, p.165-70 (1983).
The heat transfer through a fluid depends both on the thermal conductivity and the motion of the fluid. When the fluid is a certain type of liquid crystal, the motion of the fluid can be controlled by an electric field. Results presented here show that the rate of heat transfer increased by at least a factor of ten when a high field was applied. Results are reported showing how a model proposed earlier can be used to explain the fluid's motion which started at the instant the field was applied. (5 refs.)

118883 Relationships between miscibility grouping and smectic mesophase structure. J.W.Goodby (Bell Telephone Labs., Murray Hill, NJ, USA).
Mol. Cryst. & Liq. Cryst. Lett. (GB), vol.92, no.6, p.171-7 (1983).
Classification of smectic liquid crystal mesophases has been based on the concept of comiscibility between like phases. Based on thermodynamic principles this categorization scheme is not related directly to the structures of the phases. The elucidation of the structures of the various smectic modifications has shown that each miscibility group possesses a set of structural parameters common to all examples of that group. Also present are structural factors which form subsets of the miscibility group. These two sets of structural characteristics are defined for each miscibility group. (22 refs.)

118884 Application of macromolecular materials in the preparation of stable layers of cholesteric liquid crystals. W.Borys, S.Klosowicz, J.Zmija (Wojskowa Akad. Tech., Warszawa, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.3, p.87-8 (March 1983). In Polish. [received: Oct. 1983]
Several alternative methods for the preparation of thermographic layers of cholesteric liquid crystals with the use of Polish-made polymeric materials have been presented. (5 refs.)

118885 Solitons in ferroelectric liquid crystal. A.S.T.Pires, F.C.Sa Barreto (Dept. de Fisica-ICEx, Univ. Federal de Minas Gerias, Belo Horizonte, Brazil).
Phys. Status Solidi b (Germany), vol.119, no.1, p.121-30 (1 Sept. 1983).
The stable phases of liquid crystals whose constituents contain chiral molecules are studied. Starting from the Landau free energy for the order parameter the soliton-lattice solution of the incommensurate phase is analysed in detail. The solutions of the normal and commensurate phases are obtained by the transfer matrix method. (11 refs.)

118886 Determination of pitch in chiral smectic C DOBAMBC. S.A.Rozanski (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland).
Phys. Status Solidi a (Germany), vol.79, no.1, p.309-12 (Sept. 1983).
Selective reflection, Lagarde, Cano, and light diffraction methods are used for the determination of the pitch in chiral smectic C DOBAMBC {i-amyl-4-[4-decyloxybenzylideneamino]-cinnamate}. All four methods give consistent results. In the selective reflection, the rotation of sample enbles the observation of the second peak previously predicted by Berreman (1973), situated at about twice the wavelength of the first peak. (18 refs.)

118887 Thermotropic homopolyesters. Investigation of the smectic phase of polyesters based on *p,p′*-bibenzoic acid. W.R.Krigbaum, J.Watanabe (Gross Chem. Lab., Duke Univ., Durham, NC, USA).
Polymer (GB), vol.24, no.10, p.1299-307 (Oct. 1983).
The authors report a study of the mesophases of the homologous series of polymers prepared from p,p'-bibenzoic acid and the tetra-, hexa-, octa-, and decamethylene glycols. These polymers are designed BBn, where n is the number of methylene units in the diol. The BB4 and BB6 polymers form a thermotropic smectic phase which was independently identified as S_A by mutual miscibility studies with a known low molecular weight mesogen, TBBA, and by X-ray diffraction studies of oriented samples. The enthalpy change for the smectic-isotropic transition is only 1.4 Kcal mol^{-1} a value consistent with a smectic phase of low order. The smectic layer spacing is shorter than the fully extended length of the repeating unit for both BB4 and BB6. Low molecular weight samples of BB6 exhibit three crystal modifications. The two higher temperature forms have the same c-axis spacing as the smectic layer spacing, 18.7 Å, while the polymorph stable at room temperature has a fibre repeat of 32 Å, indicating a still smaller distance per repeating unit, 16 Å. All of these values are smaller than the 20 Å length of the fully extended repeating unit. Shearing the smectic phase of BB6 polymers having $\eta_{\text{inh}}<0.45$ dL/g produces a highly oriented sample in which the repeating units are perpendicular to the direction of flow. Shear of the smectic phases of polymers having higher intrinsic viscosities breaks up the smectic structure, and leads to less perfect orientation of the molecules parallel to the shear direction. (25 refs.)

118888 Orientational ordering of liquid crystals considered in the molecular field approximation with a modified model potential. A.A.Gerasimov, L.N.Lisetskii.
Sov. Phys.-Solid State (USA), vol.25, no.3, p.499-500 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.872-4 (March 1983). [received: Oct. 1983]
In the approximation of an average molecular field the orientational order of nematic liquid crystals is described by a system of self-consistency equations. It follows from the results of quantum-chemical calculations that the contribution of terms with odd indices to the expansion of the angular dependence of the interaction energy of two molecules in terms of Legendre polynomials can be very considerable. Applying the standard technique used in the molecular field approximation, the authors show that the terms with odd values of M are generally retained also in the expression for the pseudopotential. (13 refs.)

118889 Possible mechanism of the spontaneous Freedericksz effect. A.V.Kaznacheev, A.S.Sonin.
Sov. Phys.-Solid State (USA), vol.25, no.3, p.528-30 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.917-20 (March 1983). [received: Oct. 1983]
In nematics having a negative dielectric anisotropy, there is observed an interesting physical effect of spontaneous loss of homeotropic orientation at a certain critical layer thickness. The critical field for the Freedericksz transition is considerably reduced. For a substance having a positive dielectric anisotropy, this effect has not been observed. The authors present a theoretical treatment of the effect by considering the free energy and surface energy of the nematic layer. (4 refs.)

118890 Structural peculiarities of liquid crystalline ordering of polymers with heavy atoms in the main chain. V.V.Tsukruk, V.N.Bliznyuk, V.V.Shilov, Yu.S.Lipatov.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1370-4 (Sept. 1983). In Russian.
Liquid crystalline polymers with heavy atoms in the main chain have been studied by X-ray and electron-microscopic methods. The size and character of aggregation of layered packs in liquid crystalline polymers were determined. Separate layered packs consist of 4 to 6 planar smectic layers 4 nm thick. (13 refs.)

Optical second harmonic generation in various liquid crystalline phases ....See Entry 118213

The orientational optical nonlinearity of planarly aligned long-pitch cholesterics ....See Entry 118234

Elastic deformations and electrohydrodynamic instabilities in large pitch cholesteric liquid crystals under an electric field ....See Entry 119083

The nematic elastic constants from the Ginzberg-Landau Hamiltonian of the nematic to isotropic phase transition ....See Entry 119190

Pressure studies of liquid crystalline transitions ....See Entry 119192

Smectic C-nematic transition in the mixtures 5_x6_{1-x}BABA ..See Entry 119193

Dynamic light scattering of surface fluctuations of a nematic liquid crystal ....See Entry 119312

Liquid crystalline organic conductors ....See Entry 119570

Photovoltaic effects in liquid crystal cells containing organic dyes ....See Entry 119658

On the electrical switching properties of polymeric liquid crystals ....See Entry 119673

Magnetic susceptibilities and the order parameters of some 4,4′-disubstituted biphenyl cyclohexanes ....See Entry 119806

^{2}H-NMR spectral patterns in magneto-aligned smectic E and G phases ....See Entry 119929

Dispersion of proton spin-lattice relaxation in a cholesteric liquid crystal ....See Entry 119934

Two dimensional NMR time evolution correlation spectroscopy in liquid crystals ....See Entry 119943

Proton dipolar spin-lattice relaxation in the smectic phases of TBBA ....See Entry 119944

Dielectric relaxation and order parameters in mixtures of 4-cyanobiphenyl and MBBA ....See Entry 119979

Influence of molecular structure on the low frequency dielectric relaxation of *p*-cyano-substituted liquid crystals in nematic solution ....See Entry 119981

Computer simulation of a nematic guest-host display ....See Entry 120024

Electro-optical behavior of a novel strong-weak and weak-weak anchored large-pitch cholesteric ....See Entry 120026

The effect of substituents at benzoic ring on the parameters of cholesteryl benzoates infrared spectra in phase transitions ....See Entry 120077

61.40 AMORPHOUS AND POLYMERIC MATERIALS

(see also 64.70P Glass transitions 81.20P to 81.20T, and 81.60 Materials science)

118891 Crystallization of amorphous silicon nitride. N.V.Kovtun, I.T.Ostapenko, N.S.Poltavtsev, I.A.Snezhko, V.R.Tarasov (Kharkov Physicotech. Inst., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.10, p.1483-4 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1726-7 (Oct. 1982). [received: Sept. 1983]
The effect of annealing under vacuum at 1570-1870K on the crystallization of amorphous Si_3N_4 obtained by a plasma-chemical method was investigated. It was shown that at 1670-1870K a stable phase of α-Si_3N_4 was formed. (8 refs.)

118892 Ordering effects in the Fe-Al system. R.Kuentzler (Lab. de Magnetisme et de Structure Electronique des Solides, Strasbourg, France).
J. Phys. (France), vol.44, no.10, p.1167-78 (Oct. 1983).
Low temperature specific heat measurements have been performed on disordered $Fe_{1-c}Al_c$ samples in the concentration range $0.10 \leq c \leq 0.50$. A drastic difference between the 'electronic' specific heat of the disordered and ordered samples is observed. This observation joined to the recent knowledge on the particularly complex phase diagram led to reconsider the results obtained about the physical properties of the FeAl alloys. A qualitative review of some physical properties, namely the specific heat, magnetic susceptibility and magnetization, show that these properties depend strongly upon the state of the system at a given concentration. The annealed (ordered), quenched (partially ordered) and cold-worked (disordered) states of samples are used to investigate the ordering effects. (79 refs.)

118893 Structural aspects of substituted morpholinium TCNQ complexes. R.J.J.Visser, J.L.De Boer (Lab. of Chem. Phys., Materials Sci. Center, Groningen, Netherlands).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1219-21 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Substituted (thio)morpholinium TCNQ complexes, of which 20 structures are known by now, have interesting aspects in phase-transitions, electrical conductivity, thermal expansion, diffuse scattering, incommensurabilities and twisted crystal forms. (6 refs.)

118894 Structure of glassy early-transition-metal—late-transition-metal hydrides. K.Samwer, W.L.Johnson (W.M. Keck Lab. of Engng., California Inst. of Technol., Pasadena, CA, USA).
Phys. Rev. B (USA), vol.28, no.6, p.2907-13 (15 Sept. 1983).
Hydrogen is used as a probe for obtaining structural information on metallic glasses. Results from experimental radial distribution functions of hydrided and unhydrided Zr_3Rh and Zr_2Pd glasses show a significant change in the nearest-neighbor distance of Zr atoms. The measured distance suggests that hydrogen occupies mainly tetrahedral sites defined by four Zr atoms under normal hydriding conditions (1 atm H_2, $\sim$200°C). A statistical model for these sites based on current dense-random-packing models is in good agreement with the observed absorption capacity for hydrogen. The authors predict that H-H interaction should limit the upper value of hydrogen content in Zr-based glasses to 2.5 (H/metal atom). (21 refs.)

A RISM analysis of structural data for tetrahedral molecular systems ....See Entry 118855

Photostimulated diffusion in semiconductors ....See Entry 119063

A theory of mechanical properties of amorphous solids ....See Entry 119096

Shear viscosity in rapidly quenched states ....See Entry 119250

Oxygen-bonding environments in glow-discharge—deposited amorphous silicon-hydrogen alloy films ....See Entry 119367

Nitrogen-bonding environments in glow-discharge-deposited *a*-Si:H films ....See Entry 119368

Bonding in hydrogenated hard carbon studied by optical spectroscopy ....See Entry 119369

Local structure of amorphous $Mo_{50}Ni_{50}$ determined by anomalous X-ray scattering using synchrotron radiation ....See Entry 119370

Effect of conditions for producing amorphous metallic films of hypereutectic iron-boron alloy on their structure ....See Entry 119377

Trends in optical parameters and band structure with increasing hydrogenation of amorphous silicon ....See Entry 119418

Polypyridinium-TCNQ complex: a new organic conductor .....See Entry 119571

Photoinduced absorption study of recombination in amorphous Si:H doped with P or B ....See Entry 119631

Changes in the remanent magnetisation, magnetoelastic coupling and Young's modulus during structural relaxation of an amorphous ribbon ....See Entry 119888

Local boron environment in $Ni_{100-x}B_x$ metallic glasses: an NMR study ....See Entry 119931

61.40D Glasses

118895 Experimental investigation on the thermal stability of metallic glasses. H.W.Bergmann, U.Brokmeier, H.U.Fritsch (Inst. fur Werkstoffkunde und Werkstofftech., Tech. Univ. Clausthal, Clausthal, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.757-61 (Sept. 1983).
There are many instances in practice of phase changes in which the initial phase, e.g. a homogeneous melt, is not replaced by one or more thermodynamic stable phases but rather by metastable phases. Knowledge of systems in which metastable phases can form has increased considerably in recent years. Rapid quenching increases the tendency to form metastable phases including ultimately for appropriate compositions the amorphous metallic glasses. In any discussion about metastable phases there arises the question of the conditions under which they form and their stability which depends on temperature, pressure and composition. Some attempts to describe the thermal stability of metallic glasses and the experimental means of measuring it are discussed. (15 refs.)

118896 Composition of phosphosilicate glass films obtained by hydrolysis of tetraethoxysilane solutions. V.M.Kedyarkin, T.I.Firsova, N.N.Vyshinskii, V.A.Alferov, G.T.Vlasenko, S.A.Krivelevich.
Inorg. Mater. (USA), vol.18, no.11, p.1639-43 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1904-8 (Nov. 1982).
Thermal treatment of phosphosilicate glass films above 200°C causes a chemical reaction between the phosphorous and the silicon-oxygen network accompanied by the formation of Si-O-P bonds. The amount of bound phosphorus increases as its concentration in the film-forming solution rises to a limit governed by the concentrations of the silanol and siloxane groups, which react with the orthophosphoric acid. The bound phosphorus is held tightly within the film. Formation of interlocking phosphosilicate chains is conducive to more compact structures. Phosphosilicate glass films are best heated under oxygen. (9 refs.)

118897 Properties and structure of glasses in the system $10K_2O{\cdot}20Ba0{\cdot}70(SiO_2, GeO_2,B_2O_3)$. G.A.C.M.Spierings (Phillips Res. Labs., Eindhoven, Netherlands).
J. Mater. Sci. (GB), vol.18, no.10, p.2963-8 (Oct. 1983).
Density, refractive index, glass transition temperature and expansion coefficient of glasses in the system $10K_2O{\cdot}20BaO{\cdot}(70\text{-}x\text{-}y)SiO_2{\cdot}xGeO_2{\cdot}yB_2O_3$ (mol%) have been determined. The structure of these glasses is discussed with emphasis on the shifts occurring in the boron and germanium coordination as a function of the relative concentrations of the three network-forming oxides. In GeO_2-rich glasses part of germanium is present as GeO_6 octahedra, which, upon the introduction of B_2O_3, are completely transformed into GeO_4 tetrehedra at $y > 10$. (16 refs.)

118898 Surface crystallization of a fluoride glass. N.P.Bansal, R.H.Doremus (Materials Engng. Dept., Rensselaer Polytech. Inst., Troy, NY, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.132-3 (Aug. 1983).
Growth of crystals on the surface of a Zr-Ba-La fluoride glass was observed by optical and scanning electron microscopy. Small, dark crystals nucleated rapidly and grew to a size of ≈ 10 μm; then they stopped growing, and wrinkled regions emerged, covering the entire crystal surface. (3 refs.)

118899 Glass forming ability of alloys on the basis of Fe-C. I.Schmidt (Inst. fur Werkstoffe, Ruhr-Univ. Bochum, Bochum, Germany).
Z. Metallkd. (Germany), vol.74, no.9, p.561-8 (Sept. 1983).
Fe-C based alloys are rapidly quenched from the liquid state. V, Cr, Mo, W, Co, Ni, B, Si, Ge, Sn are used as third alloying elements. Light- and transmission electron microscopy give information about the influence of these elements on the glass forming ability (GFA) of Fe-C alloys in connection with the arising crystalline phases and microstructures. Characteristic free energy-concentration diagrams and time-temperature-crystallization diagrams illustrate that an optimum GFA can be achieved if in addition to the thermodynamic stability of the amorphous phase the relative and kinetic stability are taken into account which characterize the velocity of the occurring crystallization reactions. (27 refs.)

118900 Investigations on demixing and crystallization behaviour of metallic glasses of the system palladium-nickel-phosphorus. G.Schluckebier, B.Predel (Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany).
Z. Metallkd. (Germany), vol.74, no.9, p.569-76 (Sept. 1983). In German.
Ni-Pd-P alloys with concentrations near the section ($Ni_{0,81}P_{0.19}$)-($Pd_{0,84}P_{0.16}$) have been rapidly quenched from the melt using the centrifuge method. Interpretation of the thermograms and Guinier photographs disclose a number of phenomena which are elapsing on the transition of the samples from the metastable into the equilibrium state during different heat treatments in a differential scanning calorimeter. Among others, this is the separation of the initial one-phase glass, after heating it over the glass temperature, into two supercooled melts, which are transformed, on cooling, into two separate glass phases. The different crystallization behavior of both the phases is investigated and its influence upon the glass transforming temperature is observed. Finally, the effects of an autothermal acceleration of the crystallization are reported about. (11 refs.)

Oscillatory behaviour of two-photon echo signals ....See Entry 118230

Homogeneous equilibria in liquid alloys and glass formation ....See Entry 119195

Properties of glasses in the system AgI-Ag_2O-B_2O_3 ....See Entry 119197

Effect of trace impurity levels on the viscosity of vitreous silica ....See Entry 119251

Raman studies of vitreous SiO_2 versus fictive temperature .....See Entry 120085

61.40K Polymers, elastomers, and plastics

118901 A note on the crystal structure of nylon-12. A.J.Owen, P.Kollross (Inst. fur Phys., Univ. Regensburg, Regensburg, Germany).
Polym. Commun. (GB), vol.24, no.10, p.303-6 (Oct. 1983).
The crystal structure of uniaxially and uniplanar-axially oriented sheets of nylon-12 was investigated by means of wide-angle X-ray scattering, and the results compared with those found in the literature. Differences in unit cell dimensions could be traced to differences in orientational symmetry of the specimens. It is suggested that nylon-12 forms random mixed crystals with respect to the directionality of the chain and that this type of statistical disorder prevents good agreement between observed WAXS intensities and predictions from perfect crystal model structures. (18 refs.)

118902 Hydrogen bonding in segmented polyurethanes: band assignment for the carbonyl region. R.E.Camargo, C.W.Macosko, M.Tirrell, S.T.Wellinghoff (Dept. of Chem. Engng. & Materials Sci., Univ. of Minnesota, Minneapolis, MN, USA).
Polym. Commun. (GB), vol.24, no.10, p.314-15 (Oct. 1983).
The extent of interurethane hydrogen bonding is frequently used to study the degree of phase separation in segmented polyether-urethanes. A series of hard and soft segment model compounds were prepared to investigate the frequency band assignment for free or hydrogen bonded urethane carbonyls in the bulk materials. Previous band assignments were done in solution. Highly crystalline hard segment model materials prepared from 4,4′ diphenylmethane diisocyanate (MDI) and normal alcohols, have a high degree of interurethane hydrogen bands. These materials display a single carbonyl peak at 1705 cm^{-1}. Soft segment materials prepared from a hydroxyl terminated polyethylene oxide capped polypropyleneoxide ($\bar{M}_n=2000$) and MDI or phenylisocyanate have essentially no interurethane hydrogen bonding due to dilution in the polyether matrix. These materials show a single band at 1730 cm^{-1}. Based on these results, previous band assignments done in solution have been confirmed. (11 refs.)

118903 Chemical doping of polyacetylene by transition metal halides. H.Shirakawa, T.Kobayashi (Inst. of Materials Sci., Univ. of Tsukuba, Ibaraki, Japan).
J. Phys. Colloq. (France), vol.44, no.C-3, p.3-10 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Doping effect of various transition metal halides on polyacetylene were studied in solution, doping as a function of doping time and solvent. (10 refs.)

118904 Chemical n-doping of polyacetylene. B.Francois, C.Mathis (Centre de Recherches sur les Macromolecules, CNRS, Strasbourg, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.21-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The mechanism of polyacetylene n-type doping is discussed. New dopants such as alkaline carbanionic salts and tetraalkyl-ammonium salt of dianionic benzophenone are reported. Swelling studies show that a polar solvent such as THF inserts reversibly in n-doped $(CH)_x$ and that the driving force of this insertion is the cation solvation energy. This solvation drastically influences electrical conductivity (σ). At low doping level σ strongly increases by THF insertion whereas σ decreases at high doping level. Doping with diphenylhexyl-lithium was performed in nonpolar solvent and σ variation with doping level is presented. (11 refs.)

118905 Structural studies of polyacetylene and its blends. S.K.Tripathy, M.Rubner, T.Emma, J.Georger, P.Cukor (Fundamental Res. Lab., GTE Labs. Inc., Waltham, MA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.37-43 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The microstructure of polyacetylene and its blends with elastomers, produced with the 'Shirakawa' catalyst has been investigated using electron microscopic techniques. Structural richness of the as synthesized material and possibilities of its modification in the polyblends is emphasized. (13 refs.)

118906 Structural studies on undoped poly(acetylene). D.C.Bott, C.K.Chai, D.L.Gerrard, R.H.Weatherhead, D.White, K.P.J.Williams (British Petroleum Res. Centre, Sunbury-on-Thames, England).
J. Phys. Colloq. (France), vol.44, no.C-3, p.45-52 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
A full investigation of the chemical structure and morphology of undoped poly(acetylene) is a necessary prerequisite for complete understanding of its novel electrical properties. Various techniques have been used to characterise poly(acetylene) produced by a number of synthetic routes. Transmission electron microscopy and electron diffraction experiments have shown unambiguously that the chain axis of poly(acetylene) is parallel to the fibril axis in all samples examined. Resonance Raman experiments have shown distributions of conjugation lengths which vary according to the synthetic route and subsequent thermal treatment. Other techniques have also been used to investigate chemical structure and defects. These results are discussed in terms of their possible effects on electrical conduction. (15 refs.)

118907 Structure and properties of conducting polyacetylene complexes. R.H.Baughman, N.S.Murthy, G.G.Miller, L.W.Shacklette, R.M.Metzger (Allied Corp., Corporate Res. Center, Morristown, NJ, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.53-9 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Experiment and theory are combined to derive crystallographic features and their consequences for polyacetylene charge-transfer complexes. A highly disordered spatial distribution of dopant is predicted and observed for lithium complexes. Periodic structures are predicted and observed for complexes involving larger dopants. The alkali metals sodium through rubidium form tetragonal channel complexes in which columns of alkali metal ions are each surrounded by four polyacetylene chains. Both first-stage and higher-stage layer complexes have been observed for iodine-doped polyacetylene. (30 refs.)

118908 Effects of sample mounting techniques on apparent polyacetylene morphology. H.Rommelmann, R.Fernquist, A.J.Epstein, T.Woerner, M.Aldissi (Xerox Webster Res. Center, Webster, NY, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.83-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Compares scanning electron micrographs of polyacetylene and iodine doped polyacetylene utilizing various conducting coatings and coating and tearing methods. The results show that the fibrillar morphology of polyacetylene does not change significantly with doping and that some coating and sample tearing methods can lead to spurious 'decoration' effects. (10 refs.)

118909 X-ray diffraction studies of iodine doped polyacetylene. P.Robin (Lab. Central de Recherches, Thomson-CSF, Orsay, France), J.P.Pouget, R.Comes, H.W.Gibson, A.J.Epstein.
J. Phys. Colloq. (France), vol.44, no.C-3, p.87-92 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
X-ray and synchrotron radiation diffraction study of the structure of cis and trans polyacetylene prepared by the Shirakawa method has been carried out. Studies of rapidly and slowly iodine doped samples confirmed that undoped regions of $(CH)_x$ remain. The undoped regions of the initially cis $(CH)_x$ are shown to isomerize to the trans structure during the doping process. (20 refs.)

118910 An X-ray investigation on cis-trans polyacetylenes. G.Perego, G.Lugli, U.Pedretti, E.Cernia (ASSORENI, Milano, Italy).
J. Phys. Colloq. (France), vol.44, no.C-3, p.93-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The formation of cis-trans mixed crystals in polyacetylene is demonstrated by X-ray diffraction data. (9 refs.)

118911 Synthesis and properties of $(CH)_x$-films prepared by polymerization of BTFM-TCDT. G.Leising (Inst. fur Festkorperphys., Stoffe Tech. Univ. Graz, Graz, Austria), F.Stelzer, H.Kahlert.
J. Phys. Colloq. (France), vol.44, no.C-3, p.139-42 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
$(CH)_x$-films were prepared by a ring-opening metathetical polymerization of 7,8-bis-(trifluoromethyl)-tricyclo-[4,2,2,0]-deka-3,7,9-triene (BTFM-TCDT). 100% trans-$(CH)_x$-films were obtained having a density considerably higher than the films prepared by the Shirakawa technique (1973). The authors present a study of the morphology by scanning-electron microscopy, of the infrared transmission, and of the conductivity before and after various doping procedures, and compare these results with properties of $(CH)_x$-films prepared by the Shirakawa technique. (3 refs.)

118912 A new form of polyacetylene. D.C.Bott, C.K.Chai (BP Res. Centre, Sunbury-on-Thames, England), J.H.Edwards, W.J.Feast, R.H.Friend, M.E.Horton.
J. Phys. Colloq. (France), vol.44, no.C-3, p.143-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors report the preparation and characterization of a new form of polyacetylene. This material appears to have a very low concentration of defects and to be largely amorphous; some aspects of its properties, in particular electrical behaviour (pristine and doped), are discussed. (9 refs.)

118913 Analogies between graphite intercalation compounds and doped polyacetylenes. S.Flandrois (Centre de Recherche Paul Pascal, Univ. de Bordeaux I. Talence, France), C.Hauw, B.Francois.
J. Phys. Colloq. (France), vol.44, no.C-3, p.523-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Graphite intercalation compounds are compared with doped polyacetylenes. It is shown that a number of analogies exist between both classes of materials, concerning, for example, the dopant species or the doping mechanism. Finally, a structure study of polyacetylene doped with iodine and sodium shows that doping may be considered as an intercalation reaction. (12 refs.)

118914 Characterization of polypyrrole. G.B.Street, T.C.Clarke, R.H.Geiss, V.Y.Lee, A.Nazzal, P.Pfluger, J.C.Scott (IBM Res. Lab., San Jose, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.599-606 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Using β,β' dimethylpyrrole polymers to reduce the structural disorder it has been possible to interpret the results of electron diffraction data and to propose an idealized structure for neutral polypyrrole. XPS data have been used to define some of the deviations from this ideal structure that are seen in actual films and the origin of some of these defects is related to the mechanism of polymerization. The planarity of the chain structure is shown to be important for high conductivity in pyrrole polymers which appears to involve spinless carriers perhaps associated with bipolarons. (19 refs.)

118915 Structural changes in polyparaphenylene by the doping with AsF_5 and alkali metals. M.Stamm, J.Hocker (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
J. Phys. Colloq. (France), vol.44, no.C-3, p.667-72 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Neutron scattering experiments have been performed on both doped and undoped polyparaphenylene (PPP) prepared by different methods. The structure of undoped PPP is refined and different structural models for doped PPP are discussed. (13 refs.)

118916 Molecular geometry of cis- and trans-polyacetylene by nutation NMR spectroscopy. C.S.Yannoni, T.C.Clarke (IBM Res. Lab., San Jose, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1191-3 (26 Sept. 1983).
The carbon-carbon bond lengths in polyacetylene have been directly measured with use of nutation NMR spectroscopy. 1.36 and 1.44 Å were found for the double and single bonds, respectively, in trans-$(CH)_x$, and 1.37 Å was found for the double bond in the cis isomer. Over the temperature range 4.2-300K, the dynamical single-double bond interchange predicted for chains in trans-$(CH)_x$ containing a mobile soliton defect was not observed. (16 refs.)

118917 Conformation of linear polymers in three dimensions. I.Majid, Z.V.Djordjevic, H.E.Stanley (Dept. of Phys., Boston Univ., Boston, MA, USA).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1282-5 (3 Oct. 1983).
By significantly extending the existing exact enumeration results, and by combining several independent analysis methods, the authors obtain accurate estimates of the leading 'scaling' exponent and the amplitudes for the $d=3$ linear-polymer radius-of-gyration problem. Specifically, they find that the mean square end-to-end distance of an *N*-step self-avoiding walk on an FCC lattice is given by the expression $\rho_N \sim AN^{2\nu}[1+B/N^{\Delta}+C/N]$ with $\nu \simeq 0.5875$, $\Delta \simeq 0.470$, $A \simeq 1.05$, $B \simeq -0.3/A$, and $C \simeq 0.25$. (10 refs.)

118918 Anionic polymerization of isoprene by the complexes oligoisoprenyllithium/tertiary polyamines in cyclohexane. III. Structural study of the polymers by ^1H NMR at 100 MHz. S.Dumas, J.Sledz, F.Schue (Lab. de Chimie Macromoleculaire, Univ. des Sci. et Tech. du Languedoc, Montpellier, France), S.Raynal, S.Bywater, D.J.Worsfold.
Polymer (GB), vol.24, no.10, p.1291-3 (Oct. 1983).
The microstructure of polyisoprene prepared anionically in the presence of catalytic amounts of *N,N,N′,N′*-tetramethylethylenediamine (TMEDA) and pentamethyldiethylenetriamine (PMDT) has been studied as a function of $r=$[TMEDA]/[living ends] and $r=$[PMDT]/[living ends]. No significant effect is observed for $r \leq 0.5$. The structure varies drastically for $r > 0.5$. The 4,3 addition increases mainly at the expense of the cis4,1 addition and a plateau is reached for $r \geq 1.0$. The results are discussed on the basis of the nature of the living species. (8 refs.)

118919 Structure and morphology of segmented polyurethanes. I. Influence of incompatibility on hard-segment sequence length. M.Xu, W.J.MacKnight, C.H.Y.Chen, E.L.Thomas (Dept. of Polymer Sci. & Engng., Univ. of Massachusetts, Amherst, MA, USA).
Polymer (GB), vol.24, no.10, p.1327-32 (Oct. 1983).
Separation of three polybutadiene/toluene diisocyanate/butane diol segmented polyurethanes by means of solvent extraction and the characterization of their fractions indicate that the molecules of the original polyurethanes are quite dissimilar in chemical composition and average hard-segment length. These polyurethanes are just blends of two fractions of segmented copolymer with very different average hard-segment content and average hard-segment length. For these polyurethanes, in addition to the segregation of the hard and soft segments, as expected usually for segmented copolymers, the segregation of macromolecules as a whole according to their composition should be considered in the interpretation of their morphology and properties and has been proved to be the origin of the existence of two hard-segment T_gs. This kind of compositional non-uniformity is the result of the poor compatibility between the components of the system. It should be a common phenomenon for segmented copolymers, but is especially obvious in the case of polybutadiene-containing polyurethanes owing to the extremely poor compatibility between their components. (18 refs.)

118920 Structure and morphology of segmented polyurethanes. II. Influence of reactant incompatibility. C.H.Y.Chen, R.M.Briber, E.L.Thomas, M.Xu, W.J.MacKnight (Polymer Sci. & Engng. Dept., Univ. of Massachusetts, Amherst, MA, USA).
Polymer (GB), vol.24, no.10, p.1333-40 (Oct. 1983).
For pt.I see ibid., vol.24, no.10, p.1327-32 (1983). By following the copolymerization of a model polyurethane system, HTPBD/2,6 (or 2,4)-TDI/BDO, by optical microscopy, it was found that initial reactant incompatibility was the key factor in determining the final morphology of bulk sample. Based on this finding and the results from the previous paper, models are proposed to describe the morphology during polymerization of this particular polyurethane system for several hard segment compositions where both macro-phase separation and micro-phase separation of reactants can occur during polymerization. The copolymerization of one seemingly compatible system, PPO-EO/MDI/BDO, which has been previously studied and commercially produced, was also followed by optical microscopy. In the size range which can be detected with an optical microscope using conventional optics, no heterogeneities were observable at the beginning of this reaction but phase separation was evident later in the reaction and can be explained by the presence of micro-phase separation of reactants. Globule and spherulite formation and the presence of multiple T_gs and T_ms observed by previous workers can be explained by the two levels of heterogenities present during polymerization. (38 refs.)

118921 Structure of dense cross-linked polymers of dimethacrylates and oligo-*n*-methacrylates. B.V.Ozerkovskii, V.D.Plotnikov, V.P.Roshchupkin.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.9, p.1816-22 (Sept. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The microtacticity of dense cross-linked polymers synthesized by radical polymerization of oligomeric dimethacrylates and oligo-*n*-methacrylates has been studied by IR-spectroscopy method, and the value of vibrational segment of the polymethacrylate chain in network polymer has been evaluated. The existence of microdomains with essentially different density of molecular packing was shown by molecular probe method. The influence of high pressures on the process of polymerization of dimethacrylates and on the structure of the polymer being formed was studied. (11 refs.)

118922 Temperature effect on domain structurization in segmented polyurethanes. B.Ya.Teitel'baum, E.T.Magdalev, T.A.Yagfarova, M.G.Zimina, N.P.Apukhtina.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.9, p.1823-9 (Sept. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The formation of domain structure and thermomechanical properties of polyesterurethane urea prepared by curing of prepolymer at 120° have been studied by X-ray and thermomechanical analysis methods. The organization of domain structure and heat-resistance of obtained X-ray-amorphous material can be essentially improved by heating up to temperatures above 120°. These facts are explained by kinetic limitation of structurization processes at the cure temperature and by the possibility of their continuation (up to the new limit) at higher temperature. The process is localized in microphase of domains and proceeds in conditions of high elasticity of material as a whole. During thermal perfectioning of the structure the crystallization of domains is also possible. (17 refs.)

Orientation of molecules of epoxide oligomers in a uniform stationary magnetic field .... See Entry 118023

Conformations of polymer chains grafted to unpermeable plane surface .... See Entry 118025

Universality for static properties of polystyrenes in good and marginal solvents .... See Entry 118859

Dynamical electron diffraction from elastically bent organic crystals .... See Entry 118991

Thermostimulated creep study of undoped polyacetylene $(CH)_x$ films .... See Entry 119099

On interaction of thermo-acoustic waves with the process of phase transition: a continuous approach. I. Constitutive equations and propagation velocities .... See Entry 119114

Effect of vitrification pressure on radius of gyration, specific heat and density of amorphous polymers .... See Entry 119198

Phase separation in blends of homopolymer and graft copolymer based on styrene and butadiene .... See Entry 119210

n-type doping of $(CH)_x$: molecular diffusion of the dopant ..... See Entry 119273

Electrical and structural properties of a new conducting polymer: pyrolytic poly (*p*-phenylene-1,3,4-oxadiazole) .... See Entry 119537

Synthesis and properties of conducting bridged macrocyclic metal complexes .... See Entry 119559

ESR study during the electrochemical n-type doping of $(CH)_x$ .... See Entry 119898

An in situ EPR study of electrochemically doped trans polyacetylene .... See Entry 119899

Magnetic resonance studies on iodine doping of polyacetylene .... See Entry 119912

Nutation NMR studies of polyacetylene .... See Entry 119927

NMR measurement of entanglement density in irradiated polyisobutylene .... See Entry 119946

Mossbauer spectroscopy studies of polyacetylene doped chemically and electrochemically with iron chlorides .... See Entry 119958

Crystallographic changes characterizing the Curie transition in three ferroelectric copolymers of vinylidene fluoride and trifluoroethylene. I. As-crystallized samples .... See Entry 119994

Crystallographic changes characterizing the Curie transition in three ferroelectric copolymers of vinylidene fluoride and trifluoroethylene. II. Oriented or poled samples .... See Entry 119995

On refractometric evaluation of properties of boundary layers of elastomers .... See Entry 120014

Preparation and properties of high quality polyacetylene .... See Entry 120053

Structural aspects of polyacetylene from resonance Raman scattering .... See Entry 120056

Structural properties of trans $(CH)_x$ from absorption and resonant Raman scattering spectra analysis .... See Entry 120057

Vibrational spectra and structure of undoped and doped polyparaphenylene .... See Entry 120066

Surface controlled crystallization of poly(tetramethylene terephthalate) .... See Entry 120267

Designed synthesis of novel one-dimensional materials with pseudo-$(SN)_x$ bundle-structure .... See Entry 120299

Thermal behaviour of poly(β-ketothioethers) .... See Entry 120307

The influence of thermal history on the microstructure of sulfonated polystyrene ionomers .... See Entry 120354

The properties of equimolar copolycarbonates of bisphenol A with bisphenol S and 1,4-bis(hydroxymethyl)cyclohexane .... See Entry 120357

Deformation and fracture behaviour of a rubber-toughened epoxy. I. Microstructure and fracture studies .... See Entry 120383

Deformation and fracture behaviour of a rubber-toughened epoxy. II. Failure criteria .... See Entry 120384

Theory of pseudo cross-link. III. Rheological behavior .... See Entry 120385

Influence of deformation on the structure of matrix of compositional material .... See Entry 120387

Some microlocal effects of mechanical loading on the crystalline lamellae in bulk high density polyethylene .... See Entry 120391

High-temperature thermoviscoelasticity of drawn poly(ethylene terephthalate) .... See Entry 120392

SANS investigation of molecular conformation in shear bands, as related to yield mechanisms in glassy polymers .... See Entry 120393

Self consistent field calculations of internal conformational states in glassy polymers .... See Entry 120394

Deformation and fracture of polydiacetylene single crystal fibres .... See Entry 120431

Molecular aspects of crack formation and healing in glassy polymers .... See Entry 120433

Correlations of the dry crazing resistance of glassy polymers with other physical properties .... See Entry 120460

Craze microstructure and micromechanics: the effects of entanglements .... See Entry 120480

Small angle electron diffraction and imaging of crazes in polystyrene .... See Entry 120483

Structural study of the cis-to-trans thermal isomerization in polyacetylene .... See Entry 120609

Polymerization of acetylene with new catalysts, new doping agents, morphology and electrical conductivity of the doped polyacetylene films .. See Entry 120627

Insertion of $FeCl_4^-$, $AlCl_4^-$ and HSO_4^- ions into polyacetylene—study of the reaction conditions and properties of the products .... See Entry 120628

Study of relaxation in cross-linked polymer compositions ......See Entry 120659

The chemical structure of conducting polyheterocyclic films: XPS studies ....See Entry 120703

Electrochemical cells employing polyacetylene and poly(p-phenylene) as active materials ......See Entry 120732

61.50 CRYSTALLINE STATE

(inc. molecular motions in solids; for magnetic structure and spin systems, see 75.25)

118923 A simple rule for finding and distinguishing triplet phase invariants with values near 0 or π with isomorphous replacement data. J.Karle (Lab. for the Structure of Matter, Naval Res. Lab., Washington, DC, USA).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.800-5 (1 Sept. 1983).
On the basis of some mathematical and physical characteristics of isomorphous-replacement experiments, it has been possible to derive a simple rule called R_{fiso} that permits the selection of those triplet phase invariants that have values close to zero or π. Test examples show that large numbers of invariants may be evaluated by means of R_{iso} with reliabilities that are potentially high, but depend, of course, on the reliability of the experimental data. In order to apply the rule, it is not necessary to know the chemical nature of the substituent atoms, their positions in the structure or their occupancy. The rule R_{iso} affords new insights into the interrelationships among isomorphous-replacement data and an alternative selection method to the use of the conditional joint probability distribution. A formula has also been derived for estimating the value of the cosine of triplet phase invariants for the native substance, $\cos(\phi_{\mathrm{hP}}+\phi_{\mathrm{kP}}+\phi_{(\bar{\mathrm{h}}+\bar{\mathrm{k}})\mathrm{P}})$, in terms of measured structure-factor magnitudes and structure-factor magnitudes associated with the contribution from substituent atoms. (11 refs.)

118924 On evaluating the standard deviation of U_{eq}. V.Schomaker, R.E.Marsh (Arthur Amos Noyes Lab. of Chem. Phys., California Inst. of Technol., Pasadena, CA, USA).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.819-20 (1 Sept. 1983).
For roughly isotropic and orthic cases the variance of U_{eq} is about one-sixth of the average of the variances of U_{11}, U_{22}, and U_{33}, i.e. only about one-half of what would be estimated on ignoring the covariances of the diagonal elements of U. (4 refs.)

118925 NMR studies of molecular motion and spin dynamics in TEA(TCNQ)$_2$. J.P.Travers, F.Devreux, M.Nechtschein (Dept. de Recherche Fondamentale, CENG, Grenoble, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1295-300 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Proton NMR line has been recorded at 250 MHz in the organic semiconductor TEA(TCNQ)$_2$ between 170 and 370K. The observation of several narrowings of the line provides clear evidence for the appearance of molecular motions. The nature of the different motions is obtained from computations. In particular, it is established that the TEA disorder is dynamic above 270K, while it is static below 205K. On the other hand, the analysis of proton nuclear relaxation time measurements data is briefly presented. An interpretation is given, which provides an estimate for the on-site electronic Coulomb interaction U. (15 refs.)

118926 Group-theoretical analysis of sodium nitrate nonrigid crystal. A.A.Korolev, V.P.Smirnov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.6-9 (Aug. 1983). In Russian.
At ~548K NO_3^- radicals of sodium nitrate begin to rotate. According to the permutation-inversion symmetry some more elements are to be included into the symmetry group of the crystal. Irreducible representations of this new group are considered. (5 refs.)

A geometric method incorporated with a computer program for indexing crystal faces of microcrystallites ......See Entry 118796

Analysis of 2k$_F$ X-ray diffuse scattering intensity in HMTSF-TCNQ ......See Entry 118999

Heat capacity of a five-coordinated iron (III) complex, iodobis(*N*,*N*-dimethyldithiocarbamato) iron (III), between 0.4 and 300K ....See Entry 119216

A comparison of the uniaxial anisotropy in sputtered Co-Re and Co-Cr perpendicular recording media ......See Entry 119878

^{1}H NMR relaxation studies of the organic conductor series (TMTTF)$_2$X; X=BF$_4$, PF$_6$, SCN ......See Entry 119940

61.50C Physics of crystal growth

(for techniques of crystal growth and film deposition, see 81.10 and 81.15; for epitaxy, thin films, see 68.55; for whiskers, see 68.70)

118927 Simple conditions for the appearance of sustained oscillations in continuous crystallizers. G.R.Jerauld, Y.Vasatis, M.F.Doherty (Dept. of Chem. Engng. & Materials Sci., Univ. of Minnesota, Minneapolis, MN, USA).
Chem. Eng. Sci. (GB), vol.38, no.10, p.1675-81 (1983).
Continuous crystallizers are known to exhibit sustained oscillations in solute concentration and size distribution. The usual stability analysis for mixed suspension, mixed product removal crystallizers is obscured by the use of dimensionless groups which not only depend upon the physical properties and control parameters in the problem but also depend upon the steady-state values of the state variables in the model. The authors introduce three new dimensionless groups for this problem which only depend upon physical properties and control parameters. These produce a stability plot which is simpler than previous attempts and lends itself to easy physical interpretation. (9 refs.)

118928 Melt growth and properties of B$_6$P crystals. G.A.Slack, T.F.McNelly, E.A.Taft (Res. & Dev., General Electric Co., Schenectady, NY, USA).
J. Phys. & Chem. Solids (GB), vol.44, no.10, p.1009-13 (1983).
The compound semiconductor boron subphosphide has, at low temperatures, an ideal stoichiometry of 6 boron atoms to 1 phosphorus atom. This unit cell contains $B_{12}P_2$ and has a density of 2.60 g/cm^3. It has been melted under inert gas pressure at 2120°C with very little loss of phosphorus. Data are presented on the diffusion coefficient of phosphorus, the refractive index, the band gap, and the optical absorption coefficient. Some optical data on B$_6$As are also given. (59 refs.)

118929 Influence of electrical fields on the nucleation of crystal growth in some cycloalcohols. M.Shablakh, L.A.Dissado, R.M.Hill (Chelsea Coll., Univ. of London, London, England).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1443-53 (Sept. 1983).
The lower cycloalcohols exist in more than one solid structural phase. In a recent investigation of the phase structure of the four cycloalcohols from cyclopentanol to cyclooctanol it was observed that time-dependent transformations between some of the phases occurred, and that at least one of these transformations was sensitive to the application of an electric field. Further field-sensitive transitions have since been observed and are reported. The effect is discussed in terms of a field-dependent nucleation of the growing phase. (10 refs.)

118930 Crystallization of TCNQ salts from acetonitrile in the presence of association equilibria. L.Komorowski, G.Malachowicz (Inst. of Organic & Phys. Chem., Tech. Univ. of Wroclaw, Wroclaw, Poland).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1207-9 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Associations in the TCNQ$^-$/TCNQ system in acetonitrile have been indicated as a possible source of impurities in tetracyanoquinodimethanides crystallized from a solution. (5 refs.)

118931 Theory of crystal ordering: hexagonal symmetry. A.C.Mitus, A.Z.Patashinskii (Inst. of Nuclear Phys., Novosibirsk, USSR).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.31-4 (3 Oct. 1983).
Using the statistical-mechanics theory of crystal ordering, the case of the hexagonal symmetry of the local order parameter (the sixth-rank tensor) is studied. The crystals metastability interval is small: $E=0.04$. The phase diagram is constructed and the explanation of non-existence of mesophase in HCP crystals is proposed. (9 refs.)

X-ray topographic studies of TEA(TCNQ)$_2$ crystals ......See Entry 119005

Dielectric, pyroelectric, and magnetic properties of BiMn$_2$O$_5$ crystals ......See Entry 119989

Growth and characterization of n-WS$_2$ and niobium-doped p-WS$_2$ single crystals ......See Entry 120229

Effects of solvents and cell design for crystal growth of organic metals ......See Entry 120233

Substitution reactions in solvent-ferrite systems and acid-base properties of the components ......See Entry 120238

Computer controlled growth of GaP by LEC technique ......See Entry 120239

Crystal growth from melts of high viscosity ......See Entry 120240

Stability of a vertical melt zone ......See Entry 120241

61.50E Crystal symmetry; models and space groups, and crystalline systems and classes

118932 Finite subgroups of the group GL(n,Z). P.M.Gudivok, A.A.Kirilyuk, V.P.Rud'ko, A.I.Tsitkin.
Cybernetics (USA), vol.18, no.6, p.788-803 (Nov.-Dec. 1982). Translation of: *Kibernetika (USSR)*, vol.18, no.6, p.71-82 (Nov.-Dec. 1982). [received: Sept. 1983]
The authors present a study of finite subgroups of the complete linear GL(n,Z) (Z is the ring of rational integers) and their applications in multidimensional crystallography. (17 refs.)

118933 Moments of the trigonometric structure factor. U.Shmueli, U.Kaldor (Dept. of Chem., Tel-Aviv Univ., Ramat Aviv, Israel).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.615-21 (1 Sept. 1983).
The eighth moment of the magnitude of the trigonometric structure factor has been computed for all the space groups and all the reflection subsets giving rise to different functional forms of this quantity. This extension of previously published computations of lower moments permits the construction of four-term generalized distributions of normalized intensity, which are necessary in treating problems arising from highly heterogeneous atomic compositions in various spacegroup symmetries. The related problem of odd-even mixed partial moments of the trigonometric structure factor has also been investigated, and these mixed moments were found to vanish for all the three-dimensional space groups, confirming the correctness of the hitherto published theoretical statistics. Similar computations for the plane groups showed that non-zero values of the mixed partial odd-even moments are obtained for *p*3, *p*31*m*, *p*3*m*1, *p*6 and *p*6*m*. This result calls for some modifications of the statistical formalism to be applied to two-dimensional sets of intensity data. The modifications required for the centrosymmetric case are indicated in some detail. (25 refs.)

118934 Willis formalism of anharmonic temperature factors for a general potential and its application in the least-squares method. K.Tanaka, F.Marumo (Res. Lab. of Engng. Materials, Inst. of Technol., Yokohama, Japan).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.631-41 (1 Sept. 1983).
Willis treatment of anharmonic temperature factors including up to fourth-order terms has been generalized and incorporated into a conventional full-matrix least-squares program. The temperature factor $T(\mathrm{S})$ including the anharmonic vibration effect is formulated in the general case using Willis's method (1969) $T(\mathrm{S})$ is based on the Cartesian coordinates defined by the three principal axes of the harmonic thermal ellipsoid. The simultaneous refinement of the parameters in $T(\mathrm{S})$ with the conventional parameters in crystallography, which are based on the crystal lattice system, is possible. In order to introduce $T(\mathrm{S})$ into conventional full-matrix least-squares programs, some other relations were also derived, such as that between crystallographic symmetry and $T(\mathrm{S})$, and that among parameters due to point symmetry of the atom, and so on. The method was applied to the K and two F atoms in KCuF$_3$ crystals at 296K with the point symmetries of the sites 422, $\bar{4}2m$ and *mm*2, respectively, and Al and O atoms in α-Al$_2$O$_3$ crystals at 2170K with the point symmetries 3 and 2, respectively. (35 refs.)

118935 Bravais classes for incommensurate crystal phases. A.Janner, T.Janssen (Inst. for Theoretical Phys., Univ. of Nijmegen, Nijmegen, Netherlands), P.M.de Wolff.
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.658-66 (1 Sept. 1983).
A full classification is given of the Bravais classes of lattice of symmetry groups of incommensurate crystal phases with an internal (additional) dimensionality *d* lower than four. These Bravais classes form the basis for the derivation of superspace groups needed for the symmetry classification of incommensurate crystal phases. By means of examples it is indicated how the information contained in the various tables can be extracted and used, for example, for the derivation of superspace groups. (13 refs.)

118936 Wyckoff positions used for the classification of Bravais classes of modulated crystals. A.Janner, T.Janssen (Inst. for Theoretical Phys., Univ. of Nijmegen, Nijmegen, Netherlands), P.M.de Wolff.
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.667-70 (1 Sept. 1983).
Wyckoff positions of centrosymmetric symmorphic space groups, if properly interpreted, can be used to derive the Bravais classes of modulated crystals. This program is worked out for the incommensurate case and assuming that the modulation wave vectors are symmetry related, i.e. are (integral combinations of) vectors of one star. The corresponding classes are called elementary Bravais classes (EBCs). It is shown that for three-dimensional crystals the maximal internal dimension for these EBCs is nine. It is explained in what sense this approach leads to a complete list. (3 refs.)

118937 Determination of the Bravais class for a number of incommensurate crystals. A.Janner, T.Janssen (Inst. for Theoretical Phys., Univ. of Nijmegen, Nijmegen, Netherlands), P.M.de Wolff.
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.671-8 (1 Sept. 1983).
For a number of incommensurate crystal phases with a one-dimensional modulation and for all those with a higher-dimensional modulation which are known to the authors, the Bravais class is determined. This is done partly to illustrate the use of the complete list of Bravais classes published in a previous paper [Janner, Janssen & de Wolff (1983). Acta Cryst. A39, 658-666] partly to give an overview of the crystals having higher-dimensional modulation. (24 refs.)

118938 Space-group frequencies for organic compounds. A.D.Mighell, V.L.Himes (Reactor Radiation Div., NBS, Washington, DC, USA), J.R.Rodgers.
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.737-40 (1 Sept. 1983).
The space-group frequency for approximately 30000 organic compounds in the NBS Crystal Data Identification file has been calculated for each of the 230 space groups. 75% of the compounds have been reported in only five space groups: $P2_1/c$ (36.0%), $P\bar{1}$ (13.7%), $P2_12_12_1$ (11.6%), $P2_1$ (6.7%) and $C2/c$ (6.6%). In contrast, there are 29 space groups with only one entry and 35 space groups with none at all. Although the space-group frequencies should be fairly representative of their distribution in nature, certain frequencies are over- or underestimated. An analysis of the metric symmetry for about 30000 lattices using a matrix technique has revealed that it is not uncommon for the metric symmetry to exceed the reported crystal symmetry. (10 refs.)

118939 A reformulation of the basis of crystal physics. R.R.Birss (Dept. of Pure & Appl. Phys., Univ. of Salford, Salford, England).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.747-53 (1 Sept. 1983).
The basis of crystal physics, namely the classification of tensors by rank and according to parity (i.e. polar or axial) is closely examined and found to be fundamentally deficient. An appreciation of the importance of a pre-metrical approach that stresses the role of invariant objects leads to a superior description in terms of differential forms. Rank is then replaced by the degree of the form and parity is replaced by a distinction between inner and outer orientation. It is shown how these factors can be used to predict the behaviour of physical properties under active inversion, which is then the operation of fundamental importance. (30 refs.)

118940 The effect of random errors on partially phased Fourier maps. W.Jauch (Hahn-Meitner-Inst. fur Kernforschung, Berlin, Germany).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.756-61 (1 Sept. 1983).
Probability methods are used to investigate the effect of random errors on partially phased Fourier maps of non-centrosymmetric structures. Two sources of error are considered: (i) inaccuracies in the atomic coordinates of the phasing model; (ii) errors in the observed structure-factor magnitudes. Expressions for both the error level in the unit cell and the peak heights at the atomic positions are derived. The results are illustrated for neutron diffraction studies of proteins. (10 refs.)

118941 A varying-step algorithm for numerical integration of Takagi-Taupin equations. Y.Epelboin (Univ. Pierre et Marie Curie, Paris, France).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.761-7 (1 Sept. 1983).
The numerical integration of the Takagi-Taupin equations using a constant step of integration does not allow the simulation of traverse topographs since the accuracy of the computation is rather poor. A new algorithm is described in which the step of integration varies inside the crystal, following the oscillations of the amplitudes of the wavefields. The precision becomes good enough to simulate either section topographs, taking into account the real width of the incident beam, or traverse topographs. (16 refs.)

118942 Extrapolative filtering. II. Formalism for a maximum-entropy enhancement of resolution in *n* dimensions. D.M.Collins, M.C.Mahar (Dept. of Chem., Texas A&M Univ., College Station, TX, USA).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.777-83 (1 Sept. 1983).
For pt.I see ibid, vol.34, p.533 (1978). An extrapolative filtering formalism is used to determine a high-resolution positive-definite density estimator. In an example, comparison with results from Fourier transformation of structure factors shows a resolution enhancement factor of 1.3 for the density estimator. The density estimator satisfies a maximum-entropy criterion and is the direct-space representation of a maximum determinant of structure factors as used in phase determination. (14 refs.)

118943 Unbiased three-dimensional refinement of heavy-atom parameters by correlation of origin-removed Patterson functions. T.C.Terwilliger, D.Eisenberg (Dept. of Chem., Univ. of California, Los Angeles, CA, USA).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.813-17 (1 Sept. 1983).
A procedure is presented for three-dimensional refinement of heavy-atom parameters without the use of phase information in the methods of single and multiple isomorphous replacement. This procedure is based on the Patterson-function correlation method of Rossmann [Acta Cryst. (1960), 13, 221-6] except that the origins of the Patterson functions are now removed from this correlation and centric and acentric reflections are treated separately. The resulting procedure is shown theoretically and by application to three test cases to yield accurate and essentially unbiased estimates of the occupancies, thermal parameters, and positions of heavy-atom sites. (13 refs.)

The symmetry of convergent-beam electron diffraction patterns from bicrystals .... See Entry 118827

A simple rule for finding and distinguishing triplet phase invariants with values near 0 or π with isomorphous replacement data .... See Entry 118923

Theory of crystal ordering: hexagonal symmetry .... See Entry 118931

Graphical enumeration of polyhedral clusters .... See Entry 118944

Molecular conformation of di-*o*-anisylcarbinol: an X-ray diffraction study .... See Entry 118988

Structure of rhodocladonic acid. X-ray crystal structure analysis of its triacetate .... See Entry 118989

Special points of the Brillouin zone and their use in the solid state theory .... See Entry 119404

^{87}Rb electric field gradient tensors and the symmetry of the incommensurate phase in Rb_2ZnBr_4 and Rb_2ZnCl_4 .... See Entry 119531

61.50J Crystal morphology and orientation

118944 Graphical enumeration of polyhedral clusters. F.C.Hawthorne (Dept. of Earth Sci., Univ. of Manitoba, Winnipeg, Manitoba, Canada).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.724-36 (1 Sept. 1983).
The following hypothesis is proposed: crystal structures may be ordered or classified according to the polymerization of those coordination polyhedra (not necessarily of the same type) with the higher bond valences. The linkage of polyhedra to form clusters is considered from a graph-theoretic viewpoint. Polyhedra are represented by the chromatic vertices of a (labelled) graph, in which different colours indicate coordination polyhedra of different type. The linking together of polyhedra is denoted by the presence of an edge or edges between vertices representing linked polyhedra, the number of edges between two vertices corresponding to the number of corners (atoms) common to both polyhedra. (31 refs.)

A reformulation of the basis of crystal physics .... See Entry 118939

A morphological description of the secondary structure of disperse carbon, synthesized by a polycondensation method .... See Entry 120680

61.50K Crystallographic aspects of polymorphic and order-disorder transformations

118945 Anion ordering in $(TMTTF)_2ReO_4$: a displacive transition. S.S.P.Parkin, J.J.Mayerle, E.M.Engler (IBM Res. Lab., San Jose, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1105-9 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors have synthesized single crystals of $(TMTTF)_2ReO_4$ and find this compound undergoes an anion order-disorder transition near 160K at 1 bar, involving the formation of a 2×2×2 superlattice, resulting in a metal-insulator transition. They have carried out a complete determination of the crystal structure in the anion ordered phase. They find the ReO_4 anions are displaced out of the plane of the anion array towards the neighbouring TMTTF molecule, with a considerable reduction in the closest O-S bond distance. This behaviour may provide an explanation for the very large energy gap observed in the insulating phase, and strongly suggests the anion order-disorder transition is driven by the anion array and not the host organic material. (11 refs.)

118946 Polymorphic phase transitions in alkali cyanide crystals. R.W.Impey, S.Nose, M.L.Klein (Div. of Chem., Nat. Research Council of Canada, Ottawa, Ontario, Canada).
Mol. Phys. (GB), vol.50, no.1, p.243-6 (Sept. 1983).
The authors have presented the results of a preliminary study of the polymorphic transition in solid KCN using the NMD method. They have demonstrated that structural phase transformations in solids can be observed with modest amounts of computer time. (17 refs.)

118947 Calculation of the properties and the structure of ordering alloys of the Cu-Au system. S.F.Kolodeznaya, E.V.Kozlov (Civil Engng. Inst., Tomsk, USSR).
Phys. Status Solidi b (Germany), vol.119, no.1, p.131-9 (1 Sept. 1983).
By using the method of OPW-pseudopotential (OPW-PP) the ordering energy of copper-gold alloys, the short-range and long-range order structures, and the transition temperaure are calculated. In many parameters the calculated values are in good agreement with the experimental ones. The level of approximation and the ways of the further development of the theory are discussed. (35 refs.)

Role of cations in the conformation of iota and kappa carrageenan .... See Entry 118006

X-ray diffraction study of californium metal to 16 GPa .... See Entry 118959

Crystal data for two orthophosphates: α-$NaCuPO_4$ and β-$AgCuPO_4$ .... See Entry 118969

X-ray diffraction and absorption spectrophotometric studies of AmI_3 and AmOI .... See Entry 118970

Neutron-diffraction study of polycrystalline H_2SO_4 and H_2SeO_4 .... See Entry 118986

Polymorphic transformations of rare-earth oxides under shock stress .... See Entry 119171

Neutron powder diffraction study of phase transitions and structures of $(KCN)_x(KBr)_{1-x}$ mixed crystals .... See Entry 119185

61.50L Crystal binding

118948 The bonding properties of mercury-cadmium telluride. W.A.Harrison (Appl. Phys. Dept., Stanford Univ., Stanford, CA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1672-3 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
Recently developed bonding theory, applied to HgTe and CdTe predicts the elastic and plastic rigidity of the two compounds relative to each other and relative to silicon. (3 refs.)

118949 Characteristics of the crystals of derivatives of $12CaO.7Al_2O_3$. G.I.Zhmoidin, G.S.Smirnov (A.A. Baikov Inst. of Metall., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1595-601 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1856-62 (Nov. 1982).
In the isomorphous series of derivatives of the compound $12CaO.7Al_2O_3$ the degree of covalence of the bond increases by 8.5 rel.% in the direction $2F^- < 2(OH^-) < O^{2-} < S^{2-}$. In the calculation of the material balance and the balance of the refractions for the actually obtained crystals of $12CaO.7Al_2O_3$ it was found that in one formula unit 0.25 mole of CaO is substituted by 0.25 mole of $Ca(OH)_2$ and 0.05 mole of O_2. The variation in the covalence of the bond within the investigated isomorphous series correlates well with the variation in the microhardness, which increases in the crystals $11CaO.7Al_2O_3.CaF_2 < 12CaO.7Al_2O_3 < 11CaO.7Al_2O_3.CaS$ from 720 to 110×10^7 Pa. On the basis of the obtained relationships conclusions were reached about the change in structure during fusion and glass formation in the $12CaO.7Al_2O_3$ crystal and about the characteristics of the hypothetical

anhydride crystal of 12 $CaO.7Al_2O_3$, a distinctive feature of which must be the decrease in the refractive index from 1.608 to 1.601. (7 refs.)

118950 Metal-metal bonding with reduced halides and halide carbides of rare earth metals. A.Simon (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.369-70 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
Special aspects of a d metal chemistry of low valent lanthanide halides (metal clusters, condensed clusters, heteroatoms in clusters) are discussed. (15 refs.)

118951 Cohesive energy of MAX compounds (M=Ca, Sr, Ba; A=H, F; X=Cl, Br, I) of PbFCl structure. M.Sieskind, M.Ayadi (Univ. Louis Pasteur, Strasbourg, France).
J. Solid State Chem. (USA), vol.49, no.2, p.188-94 (Sept. 1983). In French.
The Madelung constant, the electrostatic and repulsive energies of the compounds MAX, with the PbFCl structure ($D_{4h}{}^7$), are calculated and compared with the experimental Van de Waals energy. The special case of CaHBr is discussed. (10 refs.)

118952 Semiempirical studies of core electron binding energies. II. SCC-MO calculations for uracil and its derivatives. Z.B.Maksic, K.Rupnik (Theoretical Chem. Group, Rudjer Boskovic Inst., Zagreb, Yugoslavia), A.Veseli.
J. Electron Spectrosc. & Relat. Phenom. (Netherlands), vol.32, no.2, p.163-75 (Sept. 1983).
The solid-state binding energies of uracil and some of its derivatives have been calculated using semiempirical SCC-MO intramolecular potentials expressed in the point-charge approximation. The results are essentially in satisfactory agreement with experimental data, giving at the same time a simple and transparent interpretation of the mental data, giving at the same time a simple and transparent interpretation of the ESCA spectra which is close to that suggested by chemical intuition. Splitting of some unresolved N 1 *s* peaks is proposed, and separate binding energies are attributed to particular nitrogen atoms. The relaxation energies are discussed briefly. The present and earlier evidence indicates that formal atomic charges are meaningful within the theoretical framework adopted, despite the fact that they cannot be defined in a unique fashion. (29 refs.)

118953 Van der Waals interactions between metallic chains versus Madelung energy of the charge transfer. a.Bjelis (Inst. of Phys., Univ. of Zagreb, Zagreb, Yugoslavia), S.Barisic.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1539-42 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors introduce the notion of the Van der Waals energy between the metallic chains and show that it can stabilize the TTF-TCNQ lattice, in spite of the Madelung energy which favorizes the HMTTF-TCNQ lattice. (7 refs.)

118954 Progress in cohesive energies, and in building organic unimolecular rectifiers. R.M.Metzger, C.A.Panetta (Dept. of Chem., Univ. of Mississippi, MS, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1605-11 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
From enthalpies of formation (semi-micro combustion calorimetry) and from other experimental Born-Haber cycle data, one obtains that crystalline sodium TCNQ, naphthalene TCNQ, anthracene TCNQ, TMPD TCNQ, and TTF TCNQ are more stable than their constituent neutral solid components, but that their stacking mode (segregated, mixed) and ionicity must be determined by the interplay between the cost of ionization and the various theoretical lattice energies (Madelung, polarization, dispersion, etc.). A current project will test the proposal by Aviram (1974), Ratner (1974), et al. that a molecule D-σ-A (D=donor, A=acceptor, σ=covalent sigma bridge) may be a unimolecular organic electrical rectifier. TTF has been successfully linked to TCNQ by a urethane bond; preliminary chemical results are reported. (64 refs.)

118955 Use of Harrison's potential in mixed alkali halide crystals. G.D.Jain, J.Shanker (Dept. of Phys., Agra Coll., Agra, India).
Phys. Status Solidi b (Germany), vol.119, no.1, p.79-82 (1 Sept. 1983).
Harrison's (1981) overlap repulsive potential is used for evaluating the cohesive energies and bulk modulus of alkali halide mixed crystals. This potential replaces the old and widely used Born-Mayer repulsive potential in ionic crystals. The Harrison repulsive potential is presented by a quantum mechanical analytical potential form derived from the tight binding theory. The calculations are performed for the mixed crystals of NaCl-NaBr, KCl-KBr, and KBr-KI for the entire range of composition. The results are found in good agreement with experimental data and are better than those predicted from the Born-Mayer potential. (10 refs.)

118956 Monte Carlo determination of long-range pair interaction energies from diffuse scattering of X-rays by alloys. Yu.S.Stark, A.S.Steinberg, V.M.Vasilev, V.I.Dimitrov (Dept. of Theoretical Phys., Moscow Inst. of Steel & Alloys, Moscow, USSR).
Phys. Status Solidi b (Germany), vol.119, no.1, p.147-51 (1 Sept. 1983).
A method for the determination of the long-range interparticle interaction energies in alloys from the experimentally measured short-range order parameters is presented. This way of determining which is based on the Monte Carlo Method is applied to the problem of calculating the first five pair interaction energies in Cu_3Au. The results are compared with those obtained through the analytical theories of ordering. (19 refs.)

118957 Long-period ordering in intercalated compounds. Yu.R.Zabrodskii, K.A.Katrunov, V.M.Koshkin (V.I. Lenin Polytech. Inst., Kharkov, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.522-4 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.908-10 (March 1983). [received: Oct. 1983]
One of the interesting effects observed in intercalated compounds of complex crystals is long-period ordering of the intercalated atoms and molecules both in the planes of the host crystal layers and in the perpendicular direction. The authors consider a one-dimensional Ising model of an intercalated compound. The existence of long-period superlattices gives rise to the quantum size effect and to the formation of a mini-band electron spectrum. (9 refs.)

Experimental investigation on the thermal stability of metallic glasses .... See Entry 118895

Single crystal X-ray study of Mo_6Se_8-type selenides containing partially substituted $(Mo,Me)_6$ clusters (Me=Ru, Re) .... See Entry 118979

Geometric and electronic structural characterization of (3-cyano-4,5-dimethyl pyrrol-2-yl) oxamic acid ethyl ester using X-ray diffraction and ab initio quantum mechanics .... See Entry 118987

Molecular conformation of di-*o*-anisylcarbinol: an X-ray diffraction study .... See Entry 118988

Hydrogen bond formation and anion ordering in superconducting $(TMTSF)_2ClO_4$ and $(TMTSF)_2AsF_6$ .... See Entry 119003

Temperature dependence of the theoretical strength of simple cubic lattices .... See Entry 119085

Lattice dynamics of thin ionic slabs. I. The electrostatic energy .... See Entry 119125

Lattice dynamics of thin ionic slabs. II. The long-range forces .... See Entry 119126

Unified study of the lattice-mechanical properties of copper halide crystals .... See Entry 119132

Electronic structure and bonding in transuranics: comparison with lanthanides .... See Entry 119420

Relation between the electronic states and structural properties of $Hg_{1-x}Cd_xTe$ .... See Entry 119426

Band gap variation and lattice, surface, and interface 'instabilities' in $Hg_{1-x}Cd_xTe$ and related compounds .... See Entry 119428

Site inequivalence in $Fe_{1+x}Nb_{3-x}Se_{10}$ .... See Entry 119432

Total energy of Al within the neutral-pseudoatom model .... See Entry 119495

The isotropic hyperfine interaction in ternary complexes of copper(II) with 8-hydroxyquinoline and various salicyclic acids .... See Entry 119904

Raman spectra of sodium sulphamate single crystal .... See Entry 120039

Energy spectrum of electrons of solid solutions in the TiC-TiN system .... See Entry 120199

61.55 SPECIFIC STRUCTURE OF ELEMENTS AND ALLOYS

61.55D Nonmetallic elements

118958 Precision interplanar spacing measurements of boron-doped silicon. D.A.Werner Soares (Escola Federal de Engenharia de Itajuba, IBA, Itajuba, Brazil), C.A.Pimentel.
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.486-92 (1 Oct. 1983).
A study of the lattice parameters of boron-doped silicon (10^{14}-10^{19} cm^{-3}) grown in ⟨111⟩ and ⟨001⟩ directions by the Czochralski technique has been undertaken. Interplanar spacings (d) were measured by the pseudo-Kossel technique to a precision of 0.001%; different procedures to obtain d and the errors are discussed. The crystallographic planes are found to contract preferentially and the usual study of parameter variation must be made as a function of d. The diffused B particularly contracts the {333} plane, which is more pronounced in high concentrations. An orientation dependence of the diffusion during growth was observed. (26 refs.)

61.55F Metallic elements

118959 X-ray diffraction study of californium metal to 16 GPa. J.R.Peterson (Inst. fur Heisse Chem., Kernforschungszentrum Karlsruhe, Karlsruhe, Germany), U.Benedict, C.Dufour, I.Birkel, R.G.Haire.
J. Less-Common Met. (Switzerland), vol.93, no.2, p.353-6 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
The first series of measurements to determine the structural behavior of californium metal under pressure is reported. The initial double-hexagonal close-packed (d.h.c.p.) structure transformed sluggishly with increasing pressure to an f.c.c. structure. A bulk modulus of 50±5 GPa was derived for d.h.c.p. californium metal from the data for the relative volumes V/V_0 at pressures up to 10 GPa. (7 refs.)

The symmetry of convergent-beam electron diffraction patterns from bicrystals .... See Entry 118827

Magnetic, chemical and structural ordering in transition metals .... See Entry 119821

61.55H Alloys

118960 The local atomic order of a Ni-12.7 at.% Al alloy quenched from 1323K. J.E.Epperson (Max-Planck-Inst. fur Metallforschung, Inst. fur Werkstoffwissenschaften, Stuttgart, Germany), P.Furnrohr.
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.740-6 (1 Sept. 1983).
High-angle X-ray diffuse scattering has been measured in a volume element in reciprocal space for a Ni-12.7 at.% Al alloy single crystal quenched from 1323K. The Cowley-Warren order parameters were determined after separation of the first- and second-order size effects, using a procedure based on the Borie-Sparks quadratic approximation of atomic displacements. The experimental order coefficients were used to reconstruct the real-space locally ordered distribution of atoms, from which the spectrum of nearest-neighbor atomic configurations was determined. Some 61% of Al atoms were found to be in a planar ordered configuration consisting of a nickel atom and four nearest-neighbor aluminium atoms, the basic structural unit of Ni_3Al. (24 refs.)

118961 Crystal structure of RENiSn and REPdSn (RE≡rare earth) equiatomic compounds. A.E.Dwight (Dept. of Phys., Northern Illinois Univ., DeKalb, IL, USA).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.411-13 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
The crystal structures of 19 ternary compounds were investigated by X-ray powder diffraction. The alloys were of (Re,Y)NiSnk and REPdSn (RE≡rare earth) equiatomic composition. The TiNiSi-type structure (oP12) was found. (3 refs.)

118962 Quantum theory of ordered alloys of transition and noble metals. E.V.Kozlov, V.M.Dement'ev (Tomsk Civil-Engng. Inst., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.12, p.1122-35 (Dec. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.12, p.63-78 (Dec. 1982). [received: Oct. 1983]
The authors aim to outline the fundamentals of a quantum theory of ordered solid solutions of transition and noble metals. The aim of the theory, in particular, is to calculate the mixing energy (the energy difference between

the pure components and the completely disordered alloy), the specific energy of ordering (the energy difference between the completely disordered and the completely ordered alloy), the pair and multiparticle energy of ordering, the type of superstructure forming and the type short-range order, the parameters of the electron phonon systems, the physical properties, etc. The theory is based on the OPW PP method. (111 refs.)

Calculation of the properties and the structure of ordering alloys of the Cu-Au system .... See Entry 118947

Monte Carlo determination of long-range pair interaction energies from diffuse scattering of X-rays by alloys .... See Entry 118956

The effect of atomic order on the superconducting properties of A-15 Nb_3Au and $Nb_3Au_{1-x}Pt_x$ alloys .... See Entry 119749

Anisotropy and exchange effects in heavy rare-earth-cobalt compounds of the RCo_5 type .... See Entry 119832

61.60 SPECIFIC STRUCTURE OF INORGANIC COMPOUNDS

118963 The experimental determination of phases of reflections from mosaic crystals. I. $ZnWO_4$. Ping Po Gong, B.Post (Phys. Dept., Polytech. Inst. of New York, New York, NY, USA).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.719-24 (1 Sept. 1983).
The signs of large numbers of phases of reflections from centrosymmetric crystals of $ZnWO_4$ have been determined by methods outlined by Post [Acta Cryst. (1979), A35, 17-21; (1983), A39, 711-718]. Fifty-three *n*-beam interactions were selected to illustrate the phase determination procedure. Methods of extracting three-beam phase information from such interactions are discussed and illustrated. (7 refs.)

118964 New calcium gallates of lanthanum and neodymium. A.A.Ismatov, Sh.Yu.Azimov, T.A.Ismatov (A.R. Beruni Tashkent Polytech. Inst., Tashkent, USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1601-3 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1863-5 (Nov. 1982).
The gallium-containing analogs of helenite $CaLaGa_3O_7$ and $CaNdGa_3O_7$ were synthesized. It was established that their physical characteristics (density, resistivity, thermal expansion coefficient, etc.) and crystal-chemical characteristics (crystal habit, unit cell parameters and size) depend on the nature of the rare-earth element. (5 refs.)

118965 Unit-cell parameters of titanium oxynitrides. S.V.Gurov, V.N.Troitskii, V.I.Torbov, V.V.Kireiko (Inst. of New Chemical Problems, Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.10, p.1489-92 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1733-5 (Oct. 1982). [received: Sept. 1983]
The formation of oxynitride phases on sintering highly dispersed titanium nitride obtained by the plasmochemical method leads to a decrease in the unit-cell parameter from 0.4245 to 0.4236 nm in the initial stage of oxidation (up to oxygen contents within 5 mass %), due to the replacement of nitrogen by oxygen in the oxynitride with a stoichiometric ratio of nonmetal to metal. (10 refs.)

118966 Crystal data for $Rb_2CoCl_4.2H_2O$. J.Hybler, M.Havrankova (Inst. of Phys., Acad. of Sci., Praha, Czechoslovakia).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.575 (1 Oct. 1983).
Summary form only given, as follows. This compound is triclinic, probably isostructural with $Rb_2MnCl_4.2H_2O$, the space group is $P1$ or $P\bar{1}$, $a=6.50\pm0.04$, $b=6.99\pm0.04$, $c=5.58\pm0.03$ Å, $\alpha=92.8\pm0.1°$, $\beta=97.2\pm0.1°$, $\gamma=65.4\pm0.1°$, $V=228.76\pm0.06$ Å^3, $Z=1$, $D_m=2.94\pm0.03$, $D_x=2.96$ g cm^{-3}. The precession method and Zr-filtered Mo $K\alpha$ radiation ($\lambda=0.7107$ Å) were used. The specimen preparation, chemical analysis, morphology and a comparison with similar substances are given. (no refs.)

118967 Crystal data for magnesium decavanadate, $Mg_3V_{10}O_{28}.28H_2O$. G.Rigotti, M.E.Escobar, E.J.Baran (Facultad de Ciencias Exactas, Univ. Nacional de La Plata, La Plata, Argentina).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.575 (1 Oct. 1983).
Summary form only given, as follows. Crystal data for $Mg_3V_{10}O_{28}.28H_2O$ were determined from oscillation, Weissenberg and precession photographs using Cu $K\alpha$ radiation ($\lambda=1.54178$ Å). The substance is triclinic, space group $P\bar{1}$, $Z=2$, and lattice constants $a=10.53$ (5), $b=10.73$ (6), $c=21.28$ (9) Å, $\alpha=90.2(1)$, $\beta=97.5$ (2) and $\gamma=104.1(3)°$, $V=2310$ (25) Å^3 and the measured and calculated densities are 2.17(10) and 2.20 Mg m^{-3}, respectively. The crystals were also characterized by TG/DTA measurements and vibrational spectroscopy. (no refs.)

118968 Crystal data for $CuGa_xIn_{1-x}Te_2$. B.Grzeta-Plenkovic, B.Santic (Ruder Boskovic Inst., Zagreb, Yugoslavia).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.576 (1 Oct. 1983).
Summary form only given, as follows. A series of samples in the system $CuGa_xIn_{1-x}Te_2$, $0\leq x\leq1$, has been synthesized and characterized by X-ray diffraction. All the samples have a chalcopyrite-type structure, the unit-cell parameters a and c and the ratio c/a changing linearly with x. The unit-cell parameters for the compounds with $x=1$, 0.80, 0.65, 0.50, 0.30, 0.15 and 0 and the pwder diffractometer data for $x=1$, 0.5 and 0 are given at 298K. $CuGaTe_2$: $a=6.021(2)$, $c=11.937(5)$ Å, $V=432.75$ Å^3, $D_x=5.96$ g cm^{-3}: $CuGa_{0.80}In_{0.20}Te_2$; $a=6.053(2)$, $c=12.039(4)$ Å, $V=441.09$ Å^3, $D_x=5.99$ g cm^{-3}: $CuGa_{0.65}In_{0.35}Te_2$; $a=6.084(2)$, $c=12.107(7)$ Å, $V=448.14$ Å^3, $D_x=5.99$ g cm^{-3}; $CuGa_{0.50}In_{0.50}Te_2$: $a=6.107(2)$, $c=12.177(7)$ Å, $V=454.15$ Å^3, $D_x=6.01$ g cm^{-3}; $CuGa_{0.30}In_{0.70}Te_2$: $a=6.144(2)$, $c=12.296(7)$ Å, $V=464.16$ Å^3, $D_x=6.01$ g cm^{-3}; $CuGa_{0.15}In_{0.85}Te_2$: $a=6.168(3)$, $c=12.355(10)$ Å, $V=470.04$ Å^3, $D_x=6.03$ g cm^{-3}; $CuInTe_2$: $a=6.195(2)$, $c=12.418(6)$ Å, $V=476.58$ Å^3, $D_x=6.04$ g cm^{-3}. The JCPDS Diffraction File Nos. are; 34-1500 for $CuGaTe_2$; 34.1498 for $CuInTe_2$: 34-1499 for $CuGa_{0.50}In_{0.50}Te_2$. (no refs.)

118969 Crystal data for two orthophosphates: α-$NaCuPO_4$ and β-$AgCuPO_4$. M.Quarton, M.T.Oumba (Lab. de Chimie Minerale, Univ. Pierre et Marie Curie, Paris, France), A.W.Kolsi.
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.576-7 (1 Oct. 1983).
Summary form only given, as follows. Two orthophosphates M^ICuPO_4 (with M^I=Na or Ag) have been synthesized by solid-state reaction between M_3PO_4 and $Cu_3(PO_4)_2$. Each of these compounds undergoes a phase transition and high temperature, and for $AgCuPO_4$ the polymorphic transformation is irreversible. α-$NaCuPO_4$ (low temperature) is orthorhombic, $P2_12_12_1$, a=9.7098(8), b=4.8040(3), c=7.1676(6) Å, V-334.34(7) Å^3, D_m(298K)=3.55, D_x=3.606 Mg m^{-3}, Z=4. β-$AgCuPO_4$ (high temperature) is orthorhombic, Pbca, a=7.5008(6), b=15.749(1), c=5.7030(5) Å, V=673.70(14) Å^3, D_m(298K)=5.25, D_x=5.253 Mg m^{-3} for Z=8. Powder diffraction data have been obtained at 293K with a counter diffractometer with Ni-filtered copper radiation ($\lambda=1.5418$ Å). The JCPDS Diffraction File Nos. are: 34-1496 for β-$AgCuPO_4$; 34-1497 for α-$NaCuPO_4$. (no refs.)

118970 X-ray diffraction and absorption spectrophotometric studies of AmI_3 and AmOI. R.G.Haire (Chem. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA), J.P.Young, J.R.Peterson.
J. Less-Common Met. (Switzerland), vol.93, no.2, p.339-45 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
The anhydrous tri-iodides and the oxyiodide of americium were investigated by X-ray diffraction and absorption spectrophotometry. From the X-ray analysis of the tri-iodide, an orthorhombic form ($PuBr_3$-type structure) was identified, which is isostructural with the lighter actinide (uranium through plutonium) tri-iodides. A hexagonal form (BiI_3-type structure) of the tri-iodide was also found. The transition temperature for converting the orthorhombic form to the hexagonal form was established to be 400±30°C. Room temperature lattice parameters for the tri-iodide are (1) $a_0=0.428(4)$ nm, $b_0=1.394(1)$ nm and $c_0=0.9974(7)$ nm for the orthorhombic form, and (2) $A_0=0.7637(4)$ nm and $c_0=2.091(2)$ nm for the hexagonal form. The room temperature parameters for the tetragonal oxyiodide (PbFCl-type structure) are $a_0=0.4010(4)$ nm and $c_0=0.9200(6)$ nm. From differences in the absorption spectra of the solids at 25°C, it is possible to differentiate between these three materials by absorption spectrophotometry. (14 refs.)

118971 K_2UCl_5, Rb_2UCl_5, UCl_3 and a comparison with analogous rare earth chlorides. G.Meyer, H.-C.Gaebell, R.Hoppe (Inst. fur Anorganische und Analytische Chem., Justus-Liebig-Univ., Giessen, Germany).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.347-51 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
K_2UCl_5 and Rb_2UCl_5 crystallize isotypically with K_2PrCl_5 (orthorhombic structure; space group, Pnma; Z=4). Monocapped trigonal prisms $[UCl_7]$ are connected via two common edges to chains $[UCl_5]^{2-}$ in the [010] direction. The lattice constants and molar volumes suggest that the uranium chlorides should be compared with the analogous cerium compounds. The crystal structure of UCl_3 was refined from single-crystal data. (17 refs.)

118972 Syntheses, lattice parameters and solid state absorption spectra of the first five transplutonium orthophosphates. R.G.Haire (Transuranium Res. Lab., Oak Ridge Nat. Lab., Oak Ridge, TN, USA), H.E.Hellwege, D.E.Hobart, J.P.Young.
J. Less-Common Met. (Switzerland), vol.93, no.2, p.358-9 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
Summary form only given. Studies of the orthophosphates of the first five transplutonium elements consisted of three phases: (1) their synthesis and characterization; (2) an examination of their stability toward self-irradiation; (3) a determination of the chemical and structural consequences of radioactive decay on the progeny (i.e. $Es(PO_4)\rightarrow BkPO_4\rightarrow CfPO_4$ etc.). The first phase of these studies has been completed. The crystal form, lattice parameters (except for $EsPO_4$), solid state absorption spectra and Raman spectra have been determined for these five actinides. From the data obtained it has been possible to make a systematic comparison of the basic properties of the lanthanide and transplutonium orthophosphates. The transplutonium orthophosphates were found to be isostructural with the lighter lanthanide orthophosphates (monoclinic monazite structure). Their room temperature absorption spectra confirmed that the actinides were trivalent and the spectrum for each orthophosphate exhibited sharp f-f transitions that were characteristic for each metal ion in this structural environment.

118973 Reduced ternary rare earth halides: state of the art. G.Meyer (Inst. fur Anorganische und Analytische Chem., Justus-Liebig-Univ., Giessen, Germany).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.371-80 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
Since the first discovery of Gd_2Cl_3 in 1964, a plethora of reduced binary rare earth halides with formal oxidation states less than 2+ has been obtained. Their common structural feature is an M_6 metal cluster surrounded by halide ions and, whenever necessary, edge connected. At present this appears to have no analogy in reduced ternary rare earth halide chemistry. Compounds with the oxidation state 2+ have been obtained for europium, ytterbium, samarium, thulium, dysprosium and scandium. The formula types AMX_3, A_2MX_4 and AM_2X_5 have been observed. AMX_3 compounds are either of the perovskite type (e.g. cubic $CsTmCl_3$ or $RbTmCl_3$ with three modifications and two transitions near 185 and 375°C) or isotypic with $CsNiCl_3$ (scandium (II) halides $AScX_3$ with A≡Cs, Rb, X≡Cl, Br and $CsScI_3$). A_2MX_4 compounds (examples are Cs_2YbCl_4 and Cs_2TmCl_4) are isostructural with K_2NiF_4 which is related to the perovskite structure. Samarium(II) and europium(II) halides of the AM_2X_5 type (e.g. KSm_2Cl_5) are structurally closely related to K_2SmCl_5. In KSm_2Cl_5 (equivalent to $KSm[SmCl_5]$) samarium(II) has coordination numbers of 8 and 7. The successful synthesis of ternary scandium(II) halides gave a first indication that there is a possibility of producing ternary reduced halides with other than the four classical divalent rare earths. (38 refs.)

118974 Solid state chemistry of rare earth compounds with homogeneously and heterogeneously mixed valence. E.Kaldis (Lab. fur Festkorperphys., Zurich, Switzerland).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.381-2 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
An overview of some chemical properties of the mixed valence compounds is given, with reference to recent publications. (6 refs.)

118975 The search for a trivalent thulium monotelluride. E.Kaldis, E.Jilek, H.Spychiger (Lab. fur Festkorperphys., Eidgenossiche Tech. Hochschule Zurich, Zurich, Switzerland).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.399-409 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
The existence of a $Tm^{3+}Te$ ($(4f)^{12}$) compound with the NaCl structure and the lattice constant $a=604$ Å has been reported several times in the literature for polycrystalline samples. Single crystals of pure $Tm^{2+}Te$ ($(4f)^{13}$) grown from the melt at 1950°C also have the NaCl structure but the lattice constant is much larger ($a=6.36$ Å). The authors investigate the possibility of changing the valence in TmTe by varying the stoichiometry. X-ray and chemical analyses show that the Tm^{3+} monotelluride is strongly deficient in thulium, has the Sc_2S_3 superstructure of the NaCl lattice and has the composition $Tm_{0.68}Te$ ($TmTe_{1.47}$). Density and magnetic susceptibility data support this result and show the trivalent character of thulium. The compound is stable at both low and high temperatures so that single crystals can be grown at $T\leq2000°C$. This phase is the only reaction product of the elements at $500°C\leq T\leq800°C$. They believe that the Sc_2S_3 superstructure has not been recognized in the past because of the very low intensity of the extra reflections in the X-ray film. The transition from $Tm^{2+}Te$ to ${Tm^{3+}}_{0.68}Te$ takes place via a miscibility gap and a slightly deformed NaCl structure (contrac-

tion along the diagonal owing to the increasing Tm^{3+} contribution) with a rhombohedral cell and lattice constants $a \approx 6.145$ Å and $\alpha \approx 89.08°$. (22 refs.)

118976 Anion ordering in europium(II) mixed halide systems: preparation of mixed cation fluoride halides. S.A.Hodorowicz, E.K.Hodorowicz, H.A.Eick (Michigan State Univ., East Lansing, MI, USA).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.415-18 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
The results of phase studies of EuX_2-EuX'_2 systems, where X and X′ represent the halogens chlorine, bromine and iodine, are presented and compared with previous studies of related divalent systems. All systems exhibit the $PbCl_2$-type structure over a limited intermediate composition range. In every reported study but one the anions in the $PbCl_2$-type structure region are found to be ordered, with the smaller anion occupying the tetrahedral hole. The complexity of the systems is found to correlate well with the effective size difference between the anions and the cation. Lattice parameter data for three mixed cation PbFCl-type fluoride halides are presented. (11 refs.)

118977 Synthesis and structure of $Gd_2(CO_3)_3.nH_2O$ (n=2,3). A.Sungur, M.Kizilyalli (Dept. of Chem., Middle East Tech. Univ., Ankara, Turkey).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.419-23 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
A modified procedure was used to prepare crystalline gadolinium carbonate via the hydrolysis of gadolinium trichloroacetate. Although the X-ray diffraction data obtained were almost identical with published data, there were about 25 extra diffraction lines. The powder data were indexed in the orthorhombic system with $a=6.15 \pm 0.01$ Å, $b=9.29 \pm 0.01$ Å and $c=15.26 \pm 0.01$ Å and the space group was either $I222$ or $I2_12_12_1$. The structure is closely related to those of $Er_2(CO_3)_3.2.25H_2O$ and $Ho_2(CO_3).2.25H_2O$ and does not fit the data for $Gd_2(CO_3)_3.2.58H_2O$ reported in the literature. The IR data for gadolinium carbonate show the presence of two different carbonate groups. (23 refs.)

118978 $Ln_2\mathrm{BaZnO}_5$ and $Ln_2\mathrm{BaZn}_{1-x}\mathrm{Cu}_x\mathrm{O}_5$: A series of zinc oxides with zinc in pyramidal coordination. C.Michel, B.Raveau (Univ. Caen, Caen, France).
J. Solid State Chem. (USA), vol.49, no.2, p.150-6 (Sept. 1983).
A series of zinc oxides $Ln_2\mathrm{BaZnO}_5$ has been synthesized for Ln=Sm, Eu, Gd, Dy, Ho, and Y. These phases are orthorhombic and isostructural with the copper compounds $Ln_2\mathrm{BaCuO}_5$ previously described, as shown from the structural study of one member Y_2BaZnO_5. In this structure, whose framework is built up from edge- and face-sharing $Ln\mathrm{O}_7$ polyhedra, the Zn^{2+} ions exhibit an unusual pyramidal coordination ZnO_5. The solid solution $Y_2BaZn_{1-x}Cu_xO_5$ has been studied by infrared spectroscopy and electron spin resonance (ESR). The distorted square-based pyramidal configuration of Zn^{2+} and Cu^{2+} is confirmed. The ESR spectra of diluted samples exhibit a hyperfine structure and are typical of individual Cu(II) ions. For higher Cu(II) contents, they exhibit an anisotropic broad signal which is interpreted in terms of Cu-Cu interactions. (27 refs.)

118979 Single crystal X-ray study of Mo_6Se_8-type selenides containing partially substituted $(\mathrm{Mo},Me)_6$ clusters (Me=Ru, Re). W.Honle, H.D.Flack, K.Yvon (Univ. de Geneve, Geneve, Switzerland).
J. Solid State Chem. (USA), vol.49, no.2, p.157-65 (Sept. 1983).
Atomic coordinates for rhombohedral $Mo_4Ru_2Se_8$ and $Mo_{\sim 1.5}Re_{\sim 4.5}Se_8$ are reported. The metal atom octahedra (point symmetry $\bar{3}$) are significantly smaller and less elongated (d(metal-metal)=2.66 and 2.71 Å ($Mo_4Ru_2Se_8$); 2.63 and 2.67 Å ($Mo_{\sim 1.5}Re_{\sim 4.5}Se_8$)) than those in Mo_6Se_8(2.69 and 2.84 |). The apparent contraction exceeds that expected from atomic size considerations and confirms the correlation between the valence electron concentration on the metal atom cluster and the strength of the metal-metal bonds. The bond order sums calculated from the expression $n=(d(1)/d(n))^5$ lead to a more coherent description of the metal-metal bonding than those calculated from $d(n)=d(1)-0.6\log(n)$. (23 refs.)

118980 A new delafossite-type compound $CuYO_2$. I. Synthesis and characterization. T.Ishiguro, N.Ishizawa, N.Mizutani, M.Kato (Dept. of Inorganic Materials, Tokyo Inst. of Technol., Tokyo, Japan).
J. Solid State Chem. (USA), vol.49, no.2, p.232-6 (Sept. 1983).
Single crystals of a new delafossite-type compound $CuYO_2$ were grown from a Cu_2O-Y_2O_3 melt by slow cooling from 1210°C. The crystal is hexagonal, $P6_3/mmc$, a=3.5206(1) Å, c=11.418(1) Å, Z=2 and D_x=5.01 g/cm^3. Although the crystal belongs to the 2H-polytype of the delafossite family, selected peaks showed a large line broadening on the X-ray powder profile. Correspondingly, diffuse scattering along the c axis was observed for the reflections $h-k \neq 3n$ on the precession photographs. The approximate crystal structure was analyzed by means of single-crystal X-ray diffraction with a conventional R value of 0.106. (17 refs.)

118981 Synchrotron X-ray diffraction study of the room temperature incommensurate phase in graphite-bromine intercalation compound. D.Ghosh, D.D.L.Chung (Dept. of Metall. Engng. & Materials Sci., Carnegie-Mellon Univ., Pittsburgh, PA, USA).
J. Phys. Lett. (France), vol.44, no.18, p.L761-9 (15 Sept. 1983).
Synchrotron X-ray and a four-circle diffractometer were used to study the room temperature incommensurate phase in stage-2 graphite-bromine prepared with single crystal graphite in bromine liquid. The two strongest inplane superlattice reflections and the strongest satellite peak were scanned along the most incommensurate direction of the lattice between 302K and 324K. The incommensurate-commensurate transition at 319±1K caused disappearance of the incommensurate peaks and appearance of the commensurate one. Possible models of the incommensurate phase are presented. (17 refs.)

118982 Chemistry and characterization of group V transition metal trichalcogenides. A.Meerschaut (Lab. de Chimie des Solides, Nantes, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1615-22 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Through structural determinations, electron diffraction and diffuse X-ray scattering measurements, XPS results, a survey of group VA transition metal trichalcogenides is given. Few remarks are put forward from a chemical point of view. (i) The formation of cation pairs along the chain axis determines a semiconductor behaviour. The role of impurities or chemical defects is underlined through the CDW pinning mechanism. (ii) The commensurability effect is associated with the strength of the interchain coupling: for monoclinic TaS_3 this coupling is weaker than for $NbSe_3$ which is more covalent. (iii) Polytypism is present in many systems (NbS_3, TaS_3). Some compounds can only be obtained under high pressure. (21 refs.)

118983 A new family of compounds exhibiting the $FeNb_3Se_{10}$ structural type: structural and resistivity measurements. A.Meerschaut, A.Ben Salem, L.Guemas, J.Rouxel (Lab. de Chimie des Solides, Nantes, France), P.Monceau, H.Salva.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1681-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
A new family of structure type $FeNb_3Se_{10}$ has been obtained V, Cr, Ta atoms substituting for Fe, Nb atoms in the $[(Fe,Nb)Se_6]$ octahedra chain. Preliminary magnetic susceptibility measurements are in agreement with those previously reported for $FeNb_3Se_{10}$. (8 refs.)

118984 New one-dimensional Vb transition metal tetrachalcogenides structural and transport properties. P.Gressier, A.Meerschaut, L.Guemas, J.Rouxel (Lab. de Chimie des Solides, Nantes, France), P.Monceau.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1741-3 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The series $(MX_4)_nY$ (M=Nb, Ta; X=S, Se; Y=I, Br, Cl; n=2,3,4) provides the authors with an example of a new environment of metallic atoms. From the study of the compounds $(NbSe_4)_3I$ and $(TaSe_4)_2I$, they emphasize the importance of cation pairing and of halogens number and position: $(TaSe_4)_2I$ undergoes a metal-insulator transition at T=265K, while $(NbSe_4)_3I$ is a high temperature semiconductor. (3 refs.)

118985 Modeling the spatial structures of silicas. Y.T.Thathachari, W.A.Tiller (Dept. of Materials Sci. & Engng., Stanford Univ., Stanford, CA, USA).
Prog. Cryst. Growth & Charact. (GB), vol.6, no.4, p.415-23 (1983).
The authors studies are aimed at understanding the spatial features of materials of current interest, at the atomic level. Their specific interest at the start of their program was the formation of thin films of silica and silicon suboxides-characterization of the spatial structures, mechanisms of rearrangements and the energetics involved. The authors limit ourselves in this article to silica-Si O_2. They describe how some simple ideas lead to a better understanding of some prominent features of silica structures. In these studies, they are concerned with geometrical problems in some form or other, whether they describe the structures in terms of the positions of the centers of the constituent atoms or in terms of the distribution of the charge or probability densities. There is a hierarchy of structures. At the deepest level the authors limit themselves to atoms or ions and at the other end to thin films or crystals-single crystals or crystal grains. (36 refs.)

118986 Neutron-diffraction study of polycrystalline H_2SO_4 and H_2SeO_4. A.R.Moodenbaugh, J.E.Hartt, J.J.Hurst, R.W.Youngblood, D.E.Cox, B.C.Frazer (Brookhaven Nat. Lab., Upton, NY, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3501-5 (15 Sept. 1983).
Polycrystalline H_2SO_4 and H_2SeO_4 were studied by powder neutron-diffraction techniques at temperatures near the melting points and at 10K. This work was undertaken to determine hydrogen positions and to search for order-disorder transitions in the hydrogen-bond networks. Rietveld refinement located the hydrogen positions and established that the hydrogen atoms are ordered at the temperatures studied (i.e. no ordering transitions). The other atom positions were found to be consistent with those determined in earlier X-ray single-crystal analyses of the H_2SO_4 and H_2SeO_4 crystal structures. (10 refs.)

Analogies between graphite intercalation compounds and doped polyacetylenes .... See Entry 118913

Group-theoretical analysis of sodium nitrate nonrigid crystal .... See Entry 118926

Characteristics of the crystals of derivatives of $12CaO.7Al_2O_3$ .... See Entry 118949

Metal-metal bonding with reduced halides and halide carbides of rare earth metals .... See Entry 118950

Defect structure of anion-excess fluorite-related $Ca_{1-x}Y_xF_{2+x}$ solid solutions .... See Entry 119004

Vacancy ordering in $Sc_{1-x}S$ .... See Entry 119011

Polymorphic transformations of rare-earth oxides under shock stress .... See Entry 119171

Structural phase transition of $CsPbCl_3$ below room temperature .... See Entry 119179

Mechanism of solid state transformations in single crystals of $Zn_xCd_{1-x}S$ .... See Entry 119180

Pressure-induced phase transition in β-$LiIO_3$ .... See Entry 119183

Thermal expansivity of α-$LiIO_3$ between 20 and 520K .... See Entry 119234

Effect of heat treatment on the structural characteristics and sorption properties of clinoptilolite .... See Entry 119335

Relation between the electronic states and structural properties of $Hg_{1-x}Cd_xTe$ .... See Entry 119426

New results obtained by electron diffraction on the one-dimensional conductors TaS_3 and NbS_3 .... See Entry 119448

Structural properties of III-V zinc-blende semiconductors under pressure .... See Entry 119494

Reversibility of phase transition of antiferromagnetic $CoCl_2.6H_2O$ under hydrostatic pressure .... See Entry 119836

Formation of the crystal structure of the ferrite $BaFe_{12}O_{19}$ .... See Entry 119954

Ferroelectric properties of compounds with magnesium orthotellurate structure .... See Entry 119992

Influence of the crystal structure on the luminescence properties of rare earths .... See Entry 120134

Interaction in the K_2O-Mn_2O_3-P_2H_2O system at 140-400°C .... See Entry 120231

An experiment of growing of crystals with optical transducer properties in gel and the investigation of those by X-ray method .... See Entry 120236

Equilibrium decomposition pressures of the compounds Cs_2ZrCl_6 and Cs_2HfCl_6 and X-ray identification of Na_2HfCl_6, K_2HfCl_6, and Cs_2HfCl_6 .... See Entry 120666

Relation between lattice distortions and catalytic properties of cobalt-chromium spinel solid solutions .... See Entry 120674

61.65 SPECIFIC STRUCTURE OF ORGANIC COMPOUNDS

118987 Geometric and electronic structural characterization of (3-cyano-4,5-dimethyl pyrrol-2-yl) oxamic acid ethyl ester using X-ray diffraction and ab initio quantum mechanics. D.J.Duchamp, E.C.Olson, B.V.Cheney (Res. Labs., Upjohn Co., Kalamazoo, MI, USA), J.A.Ryan, R.E.Christoffersen.
THEOCHEM (Netherlands), vol.13, no.1-2, p.179-89 (Sept. 1983).
The crystal and molecular structure of (3-cyano-4,5-dimethyl pyrrol-2-yl) oxamic acid ethyl ester has been determined by X-ray diffraction techniques. The clear monoclinic crystals, space group $P2_1/c$, were found to contain four molecules in a unit cell of dimensions $a=12.9216(4)$, $b=4.5234(2)$, $c=23.1188(8)$ Å and $\beta=119.585(2)°$. A trial structure was obtained by direct methods and refined by crystallographic least squares to a final R index of 0.084. The distances and angles in the pyrrole ring are indicative of considerable electron delocalization. Two bifurcated hydrogen bonds are found in the crystal structure, each consisting of one intramolecular and one intermolecular acceptor. Molecular orbital calculations have been performed on the molecule by means of the ab initio molecular fragment method. The calculations indicate that the isolated molecule adopts a planar conformation. The sites of high density in the higher-occupied and lower-unoccupied molecular orbitals suggest that the pyrrole moiety could effectively act either as a donor or an acceptor in a π-type charge-transfer complex. (15 refs.)

118988 Molecular conformation of di-*o*-anisylcarbinol: an X-ray diffraction study. C.Faerman, H.Negri, G.Punte (Dept. de Fisica, Nacional de La Plata, La Plata, Argentina), A.A.Vitale, N.S.Nudelman.
Can. J. Chem. (Canada), vol.61, no.9, p.2001-5 (Sept. 1983).
Di-*o*-anisylcarbinol crystallizes in the triclinic system, space group $P\bar{1}$ with $a=7.50(4)$, $b=10.89(4)$, $c=7.98(3)$ Å, $\alpha=101.9(1)$, $\beta=94.1(1)°$, $\gamma=94.6(1)°$, $Z=2$, $V=633.11$ Å^3, $D_c=1.28$ mg m^{-3} $D_m=1.26(1)$ mg m^{-3}, CuK$_\alpha$ radiation, $\lambda=1.54178$ Å, $\mu(\mathrm{CuK}_\alpha)=0.633$ mm^{-1}, $F(000)=260$. The structure has been determined by direct methods using single crystal X-ray data and refined by least-squares to the final R factors $R=5.89\%$ and $R_W=5.35\%$. The molecule has a twist-skewed conformation with the phenyl rings on nearly orthogonal planes. The crystal structure shows a hydrogen-bonded dimer and a peculiar arrangement of the methoxy and phenyl groups. (25 refs.)

118989 Structure of rhodocladonic acid. X-ray crystal structure analysis of its triacetate. S.McLean, P.Mahler, S.C.Nyburg, J.F.Sawyer, C.J.Webster, W.Wong-Ng (Dept. of Chem., Univ. of Toronto, Toronto, Ontario, Canada).
Can. J. Chem. (Canada), vol.61, no.9, p.2055-8 (Sept. 1983).
The structure of the lichen pigment rhodocladonic acid, 2-acetyl-3,4,6-trihydroxy-7-methoxynaphthol[2,3,-*b*]furan-5,8-dione(1*a*), has been assigned on the basis of an X-ray crystal structure analysis of its triacetate (1*c*0). Crystals of the triacetate are triclinic, space group $P\$\bar{1}$ with cell dimensions $a=13.609(3)$ Å, $b=15.009(3)$ Å, $c=5.456(2)$ Å, $\alpha=106.66(4)°$, $\beta=103.45(3)°$, $\gamma=72.30(4)°$, $U=1004(1)$ Å^3, and $D_{\mathrm{calc}}=1.47$ g cm^{-3} for $Z=2$; $R_1=0.0505$ for 1644 observed ($F>6\sigma(F)$) reflections. (7 refs.)

118990 Structural analysis of 3-*C*-phosphonates, -phosphinates, and -phosphine oxides of branched-chain sugars. J.-R.Neeser, M.J.Tronchet, E.J.Charollais (Inst. de Chimie Pharmaceutique et Pavillon des Isotopes, Geneve Univ., Geneve, Switzerland).
Can. J. Chem. (Canada), vol.61, no.9, p.2112-20 (Sept. 1983).
A complete NMR study (^{1}H,^{13}C,^{31}P) of twelve 3-*C*-phosphonates, -phosphinates, and -phosphine oxide derivatives of 3-*C*-branched-chain pento- and hexo-furanoses is reported. For all compounds the configuration at C_3 is determined and, for oxaphospholanes **9** to **12**, the configuration at the asymmetric phosphorus atom. The $^3\mathbf{T}_2$ conformation of the furanose ring of acylic derivatives **1** to **8** and the conformationally rigid cis-fused oxaphospholane-furanose bicyclic systems of **9** to **12** have been used to study the $^3J_{\mathrm{PCCH}}$ vs. $\theta_{\mathrm{p.H}}$ and $^3J_{\mathrm{PCCC}}$ v. $\theta_{\mathrm{p.C}}$ relationships which are specific to this series of compounds. The use of the ν P=O IR stretching frequency, δ ^{31}P chemical shift, and $^1J_{\mathrm{P.C}}$ coupling constant values in structural analysis of *C*-phosphorus-bearing sugars is also reported and discussed. (32 refs.)

118991 Dynamical electron diffraction from elastically bent organic crystals. B.Moss, D.L.Dorset (Medical Foundation of Buffalo Inc., Buffalo, NY, USA).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.609-15 (1 Sept. 1983).
Calculation of dynamical structure factors from a periodically curved crystal lattice have been carried out for the paraffin *n*-hexatriacontane, $C_{36}H_{74}$, and the linear polymer anhydrous nigeran, poly[(1→3)-α-D-maltose], $(C_{12}H_{20}O_{10})_n$. These are compared to dynamical structure factors from a flat crystal, and also to kinematic structure amplitudes from a bent lattice in order to determine the validity of considering each experimentally observed data perturbation separately. Individual treatment of these effects is found to be a good approximation so long as the crystal thickness and bend deformations are both small. (24 refs.)

118992 Studies on rare-earth carboxylates. II. Crystal chemical data on $\mathbf{Ln(CH_3CHCH_3COCO)_3}$, where Ln=Er, Tm or Yb. M.A.Nabar, S.D.Barve (Dept. of Chem., Univ. of Bombay, Bombay, India).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.576 (1 Oct. 1983).
For pt.I see Proc. 7th ICTA, Ontario, vol.1, p.464 (1982). Summary form only given, as follows. The rare-earth isobutyrates, $Ln(CH_3CHCH_3COO)_3$ (where Ln=Er, Tm or Yb), have been synthesized and studied crystallographically. The salts are orthorhombic with space-group *Pmma* containing four molecules per unit cell. The lattice parameters are: for $Er(CH_3CHCH_3COO)_3$, $a=11.35(1)$, $b=9.806(6)$, $c=15.40(2)$ Å, $V=1714$ Å^3, $D_m=1.67$, $D_x=1.66$ Mg m^{-3}, for $Tm(CH_3CHCH_3COO)_3$, $a=11.32(1)$, $b=9.781(9)$, $c=15.39(2)$ Å, $V=1703$ Å^3, $D_m=1.68$, $D_x=1.68$ Mg m^{-3}; for $Yb(CH_3CHCH_3COO)_3$, $a=11.23(2)$, $b=9.665(22)$, $c=15.34(5)$ Å, $V=1665$ Å^3, $D_m=1.68$, $D_x=1.73$ Mg m^{-3}. The JCPDS Diffraction File No. for $Tm(CH_3CHCH_3CO_2)_3$ is 34-1997. (no refs.)

118993 $\mathbf{(TMTSF)_2ClO_4}$: mean structure at 7K. Comparative study with 300K and 125K data. B.Gallois, D.Chasseau, J.Gaultier, G.Hauw (Lab. de Cristallographie, Univ. de Bordeaux I, Talence, France), A.Filhol, K.Bechgaard.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1071-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The formation of a superstructure, characterized by a (0,1/2,0) wave vector, reveals the occurrence of a phase transition at 24K which may involve the ordering of the ClO_4^- anions, in the quasi 1D conductor: $(TMTSF)_2ClO_4$. Neutron diffraction experiments were performed at 7K, in order to determine the exact low temperature structure of this compound. Preliminary results allow only to obtain a 'mean structure'. Nevertheless, from a comparative study of 295K, 125K and 7K structural data, two parameters seem relevant at very low temperature: a larger dimerization and a more pronounced interchain coupling. The temperature dependence of the lattice parameters shows a first transition at 150K which is not understood yet. (11 refs.)

118994 Influence of the disorder potential of the anions on the ground state of the organic alloy $\mathbf{(TMTSF)_2(ClO_4)_{1-x}(ReO_4)_x}$. S.Tomic, D.Jerome, D.Mailly, M.Ribault, K.Bechgaard (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1075-9 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors present experimental investigation of the organic alloy $(TMTSF)_2$ $(ClO_4)_{1-x}(ReO_4)_x$. The results show an important influence of nonmagnetic impurities on a low temperature behaviour. (5 refs.)

118995 Radical cation salts of arenes, synthesis, structures and properties. V.Enkelmann (Inst. fur Makromolekulare Chem., Freiburg, Germany).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1147-52 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Radical cation salts of arenes are obtained by anodic oxidation. They are a new family of organic conductors composed of simple and easily obtainable building blocks. The electrochemical processes leading to crystal formation, crystal structures, phase transitions and the model character for conducting polymers are discussed. (11 refs.)

118996 A new series of radical cation salts: the trimethylenetetrathiafulvalenium pseudo halides salts ($\mathbf{tTTF_2\text{-}X'}$). D.Chasseau, J.Gaultier, J.L.Miane, C.Coulon, P.Delhaes, S.Flandrois (Univ. de Bordeaux I, Talence, France), J.M.Fabre, L.Giral.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1223-7 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The X-ray crystal structures at 295K and several physical properties (electrical conductivity, paramagnetic susceptibility, EPR g-factor and linewidth) have been investigated on two typical salts ($X^-=BF_4^-$ and AsF_6^-) of a new series of one electronic chain compounds ($tTTF_2$-X′) based on the asymmetrical molecule-trimethylene 4-5 tetrathia 1.1′ 3.3′ fulvalene (tTTF). The results show two different behaviours which point out the fundamental role played by the symmetry of the counter-ion on the stacking organization of tTTF molecules. (7 refs.)

118997 Radical-cation salts of substituted perylenes. R.Lapouyade, J.P.Morand, D.Chasseau, C.Hauw, P.Delhaes (Univ. de Bordeaux I, Talence, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1235-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
A radical cation salt of 1,2,7,8-tetrahydrocyclopenta [cd:lm]perylene ($\underline{1}$) has been synthetized with the given stoichiometry $[\underline{1}]_2^{\cdot+}PF_6^-CH_2Cl_2$. Structural and physical properties (electrical conductivity, EPR) show that this new compound presents specific features. (5 refs.)

118998 Electrocrystallisation and physical properties of dimethyltetrathia-fulvalenium salts. A.Abderraba, R.Laversanne, E.Dupart, C.Coulon, P.Delhaes, C.Hauw (Univ. de Bordeaux I, Talence, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1243-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The series of radical cation salts based on the unsymmetrical dimethyl-4,5 tetrathiafulvalene molecule has been investigated: $DMTTF_2$-X′. From the observed structural and physical properties it appears that this series offers some analogy with the nonstoichiometric TTF salts. (4 refs.)

119000 Analysis of $\mathbf{2k_F}$ X-ray diffuse scattering intensity in HMTSF-TCNQ. K.Yamaji (Electrotech. Lab., Ibaraki, Japan), J.P.Pouget, R.Comes, K.Bechgaard.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1321-3 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The observed $2k_F$ X-ray diffuse scattering from HMTSF-TCNQ has been reproduced by using a model of rigid-molecular translations of HMTSF molecules with components along the a- and c-axes. The HMTSF molecule is found to translate nearly in parallel with its longest dimension in the $2k_F$ lattice modulation. (4 refs.)

119000 Diffuse X-ray scattering and order-disorder effects in the iodide chain compound 4-(2,6-diphenyl, 4-H-thiopyran-4-ylidene)-2,6-diphenyl iodide, $\mathbf{DIPS\Phi_4(I_3)_{0.76}}$. P.A.Albouy, J.P.Pouget (Lab. de Phys. des Solides, Univ. de Paris-Sud, Orsay, France), H.Strzelecka.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1339-43 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The structure of polyiodide chains in the compound $DIP\Phi_4(I_3)_{0.76}$ has been studied by X-ray scattering as a function of temperature. (11 refs.)

119001 The polaron paracrystal and the relation between diffuse and discrete satellites in 1-D bis (oxalato) platinates. A.Bertinotti, D.Luzet (Service de Phys. du Solide et de Resonance Magnetique, CENS, Gif-sur-Yvette, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1551-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The X-ray diffraction satellite spectra of various 1-D bis (oxalato) platinates, where diffuse satellite planes coexist with discrete satellite spots at the same temperature, are interpreted with a structural model based on the Wigner crystal concept. The chains are fragmented into micro-domains by periodic intrinsic defects associated with polarons. Three orthogonal deformation modes, one longitudinal and two transverse, are present in each chain; a fourth mode corresponds to a global sliding of the molecular columns. Based

on this model a significant agreement between observed and calculated satellite intensities is obtained. (11 refs.)

119002 Electrical and structural characterisation of $\mathrm{(DBzBP)(TCNQ)_4}$. G.J.Ashwell, K.Osborne (Dept. of Chem., Sheffield City Polytech., Sheffield, England).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K35-9 (Sept. 1983).
The authors report the crystal structure and conductivity of $\mathrm{(DBzBP)(TCNQ)_4}$ and also the electrical properties of the simple salt $\mathrm{(DBzBP)(TCNQ)_2}$. The structure has been investigated in order to determine the degree of back charge transfer, if any, and the degree of electron localisation on the crystallographically independent TCNQ sites. (12 refs.)

119003 Hydrogen bond formation and anion ordering in superconducting $\mathrm{(TMTSF)_2ClO_4}$ and $\mathrm{(TMTSF)_2AsF_6}$. M.A.Beno, G.S.Blackman, P.C.W.Leung, J.M.Williams (Chem. Div., Argonne Nat. Lab., Argonne, IL, USA).
Solid State Commun. (USA), vol.48, no.2, p.99-103 (Oct. 1983).
An examination of the low temperature (125K) X-ray diffraction determined structure of $\mathrm{(TMTSF)_2ClO_4}$, the only ambient pressure organic superconductor known, reveals a previously unseen nearest-neighbor hydrogen bonding environment surrounding the anion resulting in short oxygen atom to methyl-hydrogen atom interactions that are likely responsible for the ordering of the $\mathrm{ClO_4^-}$ anion associated with a transition observed at 24K. Superconductivity is observed in $\mathrm{(TMTSF)_2ClO_4}$ only when the anions adopt an ordered (relaxed) configuration. In contrast to the previously reported single short Se...O distance, the O...H-C contacts are both short and numerous. The observed librational motion of the perchlorate anion provides further support for the importance of the O...H interactions in the pinning of the anion. Additional discussion regarding the influence of F...H hydrogen bonds on the $\mathrm{AsF_6^-}$ anion disorder in $\mathrm{(TMTSF)_2AsF_6}$, a superconductor under applied pressure only, is also presented. (13 refs.)

The crystal and molecular structure of a reentrant nematogen: 4-cyanophenyl-3-methyl-4′-(4″-n-undecyloxy cinnamoyloxy)benzoate (11 CPMCB) ....See Entry 118877

Anion ordering in $\mathrm{(TMTTF)_2ReO_4}$: a displacive transition .....See Entry 118945

Lattice-dynamical evaluation of temperature factors in non-rigid molecular crystals: a first application to aromatic hydrocarbons ....See Entry 119120

Diffuse X-ray studies of the Peierls and the spin Peierls transitions in TMTTF-TCNQ and TMTTF-bromanil ....See Entry 119440

New organic conductors in TTF family ....See Entry 119567

Quasi-one-dimensional conductors based on tetrathiatetracene (TTT) and tetraselenotetracene (TSeT) with metal complex mercury anions: synthesis, structure, properties ....See Entry 119568

Two-dimensionality and anisotropy to the conductivity of a mixed valence nickel bisdithiolato-complex ....See Entry 119569

$\mathrm{[H_3NCH_2CH_2NH_3]_{0.82}[Pt(C_2O_4)_2].2H_2O}$—a new partially oxidised bis(oxalato)platinate ....See Entry 119576

Conducting cation-radical salts based on DBTTF and its selenium analogue, DBTSF ....See Entry 119579

An experiment of growing of crystals with optical transducer properties in gel and the investigation of those by X-ray method ....See Entry 120236

61.70 DEFECTS IN CRYSTALS

(see also 61.80 Radiation damage, 62. Mechanical and acoustic properties, 71.55 Impurity and defect levels, 76.30M EPR of colour centres and other defects, 78.50 Impurity and defect absorption in solids, 81.40 Treatment of materials)

119004 Defect structure of anion-excess fluorite-related $\mathrm{Ca_{1-x}Y_xF_{2+x}}$ solid solutions. J.P.Laval, B.Frit (Lab. de Chimie Minerale Structurale, UER des Sci., Limoges, France).
J. Solid State Chem. (USA), vol.49, no.2, p.237-46 (Sept. 1983).
On the basis of the transformation of a cube within a fluorite-type matrix into an archimedean antiprism of the kind found in numerous ordered anion-excess fluorite-related superstructures, a new polyhedral cluster, labeled 4:4:3 is proposed to explain the defect structure and short-range order in $\mathrm{Ca_{1-x}Y_xF_{2+x}}$ solid solution. In agreement with the spectroscopic, dielectric, and electric experiments, this new structural model fits perfectly well the measured occupation numbers for normal F and interstitial F′ and F″ fluorine atoms for the whole range of compositions without requiring the too short F′-F′ distances generated by the previously proposed 2:2:2 or 3:4:2 clusters. Such 4:4:3 clusters and nearly identical 4:4:4 or 4:4:5 ones, are probably present in the other highly and moderately doped $\mathrm{Ca_{1-x}}Ln_x\mathrm{F_{2+x}}$ solid solutions; they could be precursors for the largest clusters, i.e. ordered microdomains, observed for samples annealed for a long time. (46 refs.)

119005 X-ray topographic studies of $\mathrm{TEA(TCNQ)_2}$ crystals. A.Lindegaard-Anderson (Lab. of Appl. Phys., Tech. Univ. of Denmark, Lyngby, Denmark), M.Almeida, L.Alcacer, K.Mortensen.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1325-9 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The quality of single crystals of $\mathrm{TEA(TCNQ)_2}$, grown by controlled cooling of acetonitrile solutions, has been studied by X-ray topography. Thin plates ($\sim 0.15 \times 3 \times 15\ \mathrm{mm^3}$) carefully grown by spontaneous nucleation are highly perfect. Only a few microchannels and straight dislocations are observed. Larger crystals grown from seeds are less perfect. Typical defects are inclusions, dislocations, growth sector boundaries and growth bands. The results are correlated to growth mechanisms and can be used to optimize growth conditions. (4 refs.)

119006 Chemical nature of irradiation defects in some TCNQ salts. N.Mermilliod (Section d'Etude des Solides Irradies, CEN, Fontenay-aux-Roses, France), N.Sellier.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1353-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Correlates the resistance to irradiation of some organic conductors with their molecular structure; the authors have also investigated the chemical nature of some irradiation defects: broken bonds and formation of cross linking. (5 refs.)

119007 Indirect interaction in semiconductors. V.-C.Lee, L.Liu (Dept. of Phys. & Astron., Northwestern Univ., Evanston, IL, USA).
Solid State Commun. (USA), vol.48, no.4, p.341-4 (Oct. 1983).
The authors consider the electron mediated indirect interaction between localized neutral defects in semiconductors with s- and p-band edges located at the center of the Brillouin Zone. Based on wavefunction symmetry, they conclude that electrons occupying different valence bands mediate interactions of different signs. Quantitative calculations based on the isotropic k.p band structure for a series of III-V and II-VI semiconductors show that while the net interaction is attractive between nearest neighbor defects, it becomes repulsive for defects separated by one or more lattice constants. (3 refs.)

119008 Scattering of elastic waves from simple defects in solids, a review. B.R.Tittmann (Materials Characterization, Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA).
Wave Motion (Netherlands), vol.5, no.4, p.299-306 (Aug. 1983).
The emphasis is on the representation in the time-domain as contrasted to that in the frequency-domain, although both aspects are discussed. The defects are principally small voids ranging in shape from spherical voids to simulated flat cracks with combinations of these, such as a double void and a void surrounded by a flat crack. The defects were produced in Ti-alloy by the diffusion bonding process and were typically about 1 mm in extent. The scattered radiation pattern was probed in the $1<ka<4$ range using conventional transducers and electronics. Upon capture, the scattered waveforms were digitized and processed. Careful evaluation of the time-domain results, even before extensive signal processing, form an invaluable guide to the characterization of a simple flaw, which is the object of advanced techniques in NDE. (13 refs.)

Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride ....See Entry 116917

X-ray reflection curves of crystals with randomly distributed microdefects in the Bragg case ....See Entry 118798

The contrast of defects in inelastically scattered electrons .....See Entry 118824

Features of defect formation during ion implantation and during post-implantation annealing of semiconductor $\mathrm{A^3B^5}$ compounds .....See Entry 119046

Photostimulated diffusion in semiconductors ....See Entry 119063

Intrinsic defects of $\mathrm{TiO_2}$ (110): Interaction with chemisorbed $\mathrm{O_2}$, $\mathrm{H_2}$, CO, and $\mathrm{CO_2}$ ....See Entry 119347

Band gap variation and lattice, surface, and interface 'instabilities' in $\mathrm{Hg_{1-x}Cd_xTe}$ and related compounds ....See Entry 119428

Charge density wave domains in irradiated 1T-$\mathrm{TaS_2}$: relation with the transport properties ....See Entry 119485

Electrical properties of an irradiated methyl-pyridinium-TCNQ salt ....See Entry 119581

Domain wall pinning by defects and the C-I transition ....See Entry 119996

Comparative studies of mercury cadmium telluride single crystal and epitaxial ....See Entry 120023

The annihilation of the positron: a nondestructive research tool ....See Entry 120178

Hydrogen embrittlement of three metallic glasses ....See Entry 120414

61.70B Interstitials and vacancies

(exc. colour centres)

119009 Lattice defects in (Hg,Cd)Te: investigations of their nature and evolution. H.F.Schaake, J.H.Tregilgas, A.J.Lewis, P.M.Everett (Central Res. Labs., Texas Instruments Inc., Dallas, TX, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1625-30 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
Brief summaries of the precipitation of tellurium in (Hg,Cd)Te during the quench from the recrystallization anneal of the solid state recrystallization process and the subsequent dissolution of these precipitates during the postanneal are given. It is shown that if vacancies and interstitials are considered to be the only important point defects in the lattice, the observed mechanisms of precipitation and annihilation require that tellurium in excess of stoichiometry must be accommodated by metal vacancies. Diffusion from the mercury ambient during postanneal then must occur by metal interstitials. Enhanced self-diffusion on the metal sublattice is shown to occur along grain and subgrain boundaries. The most significant source of dark current in CID imagers fabricated on (Hg,Cd)Te is shown to be a sufficiently high dislocation density in a pixel. (32 refs.)

119010 On a point defect inside an idealized elastic sphere. Chih-Bing Ling (Dept. of Math., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA), C.R.Houska.
J. Appl. Phys. (USA), vol.54, no.9, p.5123-7 (Sept. 1983).
Presents a method of solution for the displacement, stress, and strain due to a point defect located inside a sphere. The solution is represented by a Love stress function in spherical coordinates, which is biharmonic in character. Two axisymmetric types of the point defect are considered. One is treated as a center of dilatation and the other as a double force without moment, or a doublet, oriented axisymmetrically. The Love stress function for the point defect in an infinite solid is specified in each case by a single biharmonic function. The residual tractions on the surface of the sphere left by this function are annulled by superposing two series of biharmonic functions. When the Love stress function is determined, the displacement, stress, and strain can be derived straightforwardly. (8 refs.)

119011 Vacancy ordering in $\mathrm{Sc_{1-x}S}$. H.F.Franzen, R.T.Tuenge, L.Eyring (Chem. Dept., Arizona State Univ., Tempe, AZ, USA).
J. Solid State Chem. (USA), vol.49, no.2, p.206-14 (Sept. 1983).
Presents a study of scandium vacancy ordering in slowly cooled $\mathrm{Sc_{1-x}S}$ using high-resolution electron microscopy. Previous X-rays analysis had shown segregation into alternate (111) planes of the rocksalt substructure. The present study reveals a further incommensurate ordering of the vancancies within the $(111)_c$ planes in approximately every third $(110)_{\mathrm{rhombohedral}}$ plane. The incommensurate order was easily destroyed by the irradiation and heating of the electron beam. These observations are discussed in terms of the termination of the wave vector within the Brillouin zone and described in terms of a possible continuous transition to an incommensurate Sc atom population wave. (8 refs.)

119012 Ionic and electronic processes during Frenkel defect annealing in KBr crystals above LHeT. V.Ziraps (Inst. of Solid State Phys., Latvian State Univ., Riga, Latvian SSR).
Phys. Status Solidi b (Germany), vol.119, no.1, p.49-59 (1 Sept. 1983).
The relaxation of radiation-induced optical absorption spectra and a set of thermally stimulated curves (current, depolarization current, diffusion current,

emission-desorption of gas, thermal bleaching) of KBr crystals X-irradiated at 4.6K are recorded synchronously or step by step. A multistage annealing of defects is detected: (i) from 4.6 to 32K about ten substages controlled by the I centre delocalization are accompanied by electron and energy release, (ii) from 32 to 60K about six substages controlled by the H centre delocalization are accompanied by corresponding electron and energy release and gas desorption peaks. A recombination of the migrating I or H centres within such complementary defect systems (pairs, triplets et al.) takes place: (i) $\{I...\alpha\}$, $\{I...F...V_k\}$, $\{I...F'...V_k...V_k\}$, (ii) $\{H...F\}$ and $\{H...F'...V_k\}$. Following phenomena in KBr at 4.6K are observed and discussed: (i) the 'F-photostimulated' electron tunneling transfer within the excited pair $\{F^*...H_A\}\rightarrow\{\alpha...I_A\}$, (ii) the effect of DC field (3 kV/cm) caused Frenkel defect formation efficiency increase (by$\geq$10%), (iii) the photoelectrical dissociation of the α centres. Comments about the anion Frenkel primary defect generation mechanisms are made. (27 refs.)

119013 Atomic configurations of interstitials in intermetallic compound Nb_3Sn. N.V.Moseev, V.G.Chudinov, B.N.Goshchitskii, V.I.Protasov (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Phys. Status Solidi a (Germany), vol.79, no.1, p.67-70 (Sept. 1983).
Interstitials in Nb_3Sn are investigated by a molecular dynamics technique. It is shown that around the interstitials the atomic displacements are appreciably larger than around the vacancies and antisite replacements. It is concluded that this phenomenon must lead to amorphization of Nb_3Sn under irradiation with light charged particles at low temperatures. (5 refs.)

119014 Atom-vacancy states in crystals. V.E.Panin, V.E.Egorushkin, Yu.A.Khon, T.F.Elsukova (Inst. of Atmospheric Optics, Acad. of Sci., USSR).
Sov. Phys. J. (USA), vol.25, no.12, p.1073-93 (Dec. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.12, p.5-28 (Dec. 1982). [received: Oct. 1983]
The authors substantiate the assumption that a new type of local excitation states, in dynamic equilibrium with their crystal environment, arise in crystals in an external field. These regions behave much like a supercooled liquid but are neither liquid-crystal or microcrystalline (crystallites growing in an amorphous phase) states. Their existence is possible only within a crystal with which they coexist as a two-phase system. The formation of such states plays a fundamental role in the behavior of crystals. (58 refs.)

The effect of annealing on the defect structure and electrical properties of deformed single crystals of Ge ....See Entry 119019

On the location of an absorbed hydrogen atom in aluminum metal ....See Entry 119037

Vacancy-impurity binding energy and the effective vacancy formation energy as determine from the solidus line for binary Al-based alloys ....See Entry 119053

Strengthening of GaAs by impurity atom-vacancy complexes ....See Entry 119054

Kinetics of radiation-induced segregation in Ni-12.7 at.% Si ....See Entry 119073

On the applicability of a phenomenological relationship to creep at low stresses and intermediate temperatures ....See Entry 119092

Influence of random strain fields on the frequency distribution of degenerate local vibrations ....See Entry 119138

Atomic transport via point defects in crystals. I. General kinetic theory of diffusion ....See Entry 119254

Correlation factors for atomic diffusion in nondilute multicomponent alloys with arbitrary vacancy concentration ....See Entry 119256

Electrical conductivity of Sc_2O_3-ZrO_2 compositions by 4-probe DC and 2-probe complex impedance techniques ....See Entry 119260

Self-diffusion in gallium arsenide ....See Entry 119265

Diffusion of fluorine ions in yttrium iron garnet ....See Entry 119266

Examination of models for Zn diffusion in GaAs ....See Entry 119272

Application of generalized effective mass theory to some native point defects in $Hg_{1-x}Cd_xTe$ ....See Entry 119501

Evidence for correlation effects in the hyperfine structure of the negative vacancy in silicon ....See Entry 119509

Annealing of electron-induced defects in *n*-type germanium ....See Entry 119510

Destruction of the gap in the intermediate valence compound SmB_6 by neutron irradiation ....See Entry 119522

Electronic and electrogalvanic properties of α silver telluride ....See Entry 119600

Defect chemistry and intrinsic carrier concentration for $Hg_{1-x}Cd_xTe(s)$ for $x=0.20$, 0.40, and 1.0 ....See Entry 119635

Measurement and interpretation of thermopower in oxides ....See Entry 119640

Photoionization cross section of electron irradiation induced levels in silicon ....See Entry 119648

Mixed electrical conduction in sintered BCC $6Bi_2O_3.SiO_2$ ....See Entry 119669

Surface photovoltage spectroscopy and thermally stimulated contact potential difference studies of real ZnS surfaces ....See Entry 119681

Structure and kinetics of some paramagnetic oxygen centres in synthetic calcium fluoride crystals ....See Entry 119914

Defect recovery and trapping in plastically deformed Au studied by perturbed angular correlations of ^{111}In ....See Entry 119964

On the temperature dependence of the positron annihilation spectrum from a single crystal of zinc ....See Entry 120177

Vacancy effects in the X-ray photoelectron spectra of TiN_x .See Entry 120223

Micro-scaled spectral-resolved cathodoluminescence of grains in barium titanate ceramics ....See Entry 120457

61.70D Colour centres

119015 Superhyperfine interactions of A_F centers in alkali halide crystals. P.G.Baranov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.507-8 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.884-7 (March 1983). [received: Oct. 1983]
The authors has investigated the ESR spectra of the A_F centers containing Ag in $^{85}RbCl$, $^{87}RbCl$, and ^{41}KCl crystals enriched with the indicated isotopes and have obtained information on the superhyperfine interaction of an unpaired electron or an A_F center containing Ag with the nuclei of the ligand ions, and also on the spatial distribution of the wave function of this electron. (15 refs.)

Ionic and electronic processes during Frenkel defect annealing in KBr crystals above LHeT ....See Entry 119012

The photodamping of dislocations in KC1 single crystals ....See Entry 119023

A study on electron injection in KBr single crystal ....See Entry 119068

Annealing of electron-induced defects in *n*-type germanium ...See Entry 119510

Photoionization cross section of electron irradiation induced levels in silicon ....See Entry 119648

Structure and kinetics of some paramagnetic oxygen centres in synthetic calcium fluoride crystals ....See Entry 119914

Two types of F centres in alkaline earth fluoro-halides. II. Double ENDOR experiments ....See Entry 119952

Optical absorption and thermoluminescence of bismuth-doped NaCl single crystals irradiated with X-rays ....See Entry 120158

61.70E Other point defects

119016 P_{Ga} antisite defect in Zn-implanted $GaAs_{0.1}P_{0.9}$ LED. R.Pickenhain, B.Rheinländer, S.Brehme (Wissenschaftsbereich Halbleiterphys., Sektion Phys., Karl-Marx-Univ. Leipzig, Leipzig, Germany).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K61-3 (Sept. 1983).
The authors report on injection luminescence (EL), DLTS, and optic CLTS (ODLTS) studies on yellow emitting, Zn-implanted VPE-$GaAs_{0.1}P_{0.9}$:N LED. The net donor doping level in the non-doped n-region is determined by C-V analysis to be N_D-$N_A\approx2\times10^{16}$ cm^{-3}. The diodes were stressed during 1000 h using a current density $j_s=40$ A cm^{-2}. After stressing a small increase of the net donor doping level is observed. The DLTS measurement exhibited the emergence of a deep level having a density of about 10^{13} cm^{-3} and a thermal activation energy E_c-$E_T=930$ meV below the conduction band. (5 refs.)

61.70G Dislocations: theory

119017 On the dislocation fields in terms of the dynamic Green's function. X.Markenscoff (Dept. of Mech. & Environmental Engng., Univ. of California, Santa Barbara, CA, USA).
J. Elasticity (Netherlands), vol.13, no.3, p.237-41 (1983).
The expressions for the velocity and strain fields due to moving dislocation loops are obtained as line integrals over the loop and the history of the motion. These expressions do not contain non-integrable singularities. (7 refs.)

Phase transitions in monolayers adsorbed on uniaxial substrates ....See Entry 119343

Molecular dynamics simulation of crack tip processes in alpha-iron and copper ....See Entry 120404

61.70J Etch pits, decoration, transmission electron-microscopy and other direct observations of dislocations

119018 Effects of nitrogen on dislocation behavior and mechanical strength in silicon crystals. K.Sumino, I.Yonenaga, M.Imai (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan), T.Abe.
J. Appl. Phys. (USA), vol.54, no.9, p.5016-20 (Sept. 1983).
The characteristics of dislocation behavior and mechanical strength in tensile tests are investigated on the silicon crystals that are doped with nitrogen at the time of crystal growth by the floating-zone technique. These are compared with those in the usual floating-zone-grown silicon crystals. Nitrogen atoms dispersed in a silicon crystal are shown to have no influence on the velocities of dislocations in motion in the temperature range above 600°C. Dislocations in the nitrogen-doped crystal are, however, immobilized while the crystal is kept under a low or zero applied stress at elevated temperatures. Like Czochralski-grown silicon, nitrogen-doped silicon shows a much higher yield strength than usual floating-zone-grown silicon when crystals are dislocated. It is concluded that interstitial nitrogen atoms bring about the hardening of silicon crystals through locking of dislocations upon congregating on the latter. (14 refs.)

119019 The effect of annealing on the defect structure and electrical properties of deformed single crystals of Ge. V.V.Aristov, Yu.A.Osipyan, R.Scholz, I.I.Snighireva, I.I.Khodos, S.A.Shevchenko (Inst. of Solid State Phys., Acad. of Sci., Chernogolovka, USSR).
Phys. Status Solidi a (Germany), vol.79, no.1, p.47-55 (Sept. 1983).
The dissociation of dislocations in deformed and annealed specimens of p-type germanium is studied using the weak-beam method of electron microscopy. Both the Hall EMF and DC conductivity are measured within the temperature range 4.2 to 300K. It is shown that the splitting values of dislocations with a predominant screw component depend on the cooling rate and subsequent annealing of the deformed specimens. The effect of annealing on the concentration and the mobility of current carriers is also found. It is concluded that the splitting parameters of dislocations in the specimens under study are connected with the behavior and state of point defects. (24 refs.)

119020 On the role of surface oxides in the processes of metal etching. G.K.Baranova (Solid State Phys. Inst., Acad. of Sci., Chernogolovka, USSR).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K9-12 (Sept. 1983).
Etching techniques for revealing dislocations and determining crystallographic orientation by etch figure shapes have been widely used to study the structure of metals. Principal regularities of the processes of orientation and dislocation etching of metals suited for oxidation are considered and comparison characteristics of orientation figures and dislocation etch pits are adduced. (10 refs.)

119021 Dislocation mobility in hydrostatically compressed KBr crystals. V.I.Barbashov, Yu.B.Tkachenko (Phys. Tech. Inst., Acad. of Sci., Donetsk, Ukrainian SSR).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K17-19 (Sept. 1983).
The object of the present study is to investigate weakly doped KBr crystals with yield point of about (2.2±0.1)MPa. This choice is due to the fact that KBr crystals are close to KCl concerning some physical characteristics (energy of ion bond, polarizability, energy of stacking fault, behaviour of elastic constant C_{44} with pressure). (7 refs.)

119022 Transport of electric charge by complete and partial dislocations in ZnS. A.V.Zaretskii, L.G.Kirichenko, V.F.Petrenko, G.K.Strukova, I.I.Khodos (Inst. of Solid-State Phys., Acad. of Sci., Chernogolovka, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.408-12 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.715-21 (March 1983). [received: Oct. 1983]
Plastic deformation of microtwin ZnS crystals was found to involve simultaneous motion of complete and partial dislocations. It was possible to select the deformation conditions so that one or the other type of dislocation predominated: in such situations the dependences of the electric charge of moving dislocations on the temperature and rate of deformation were similar to those observed earlier for other II-VI compounds. (23 refs.)

Theoretical study of the influence of the width of the entrance slit on the contrast of dislocations in X-ray topography by means of simulations .... See Entry 118799

Lattice defects in (Hg,Cd)Te: investigations of their nature and evolution .... See Entry 119009

EBIC characterization of electrically active defects in (Hg,Cd)Te .... See Entry 119024

Anomalous temperature dependence of the drag coefficient of a twinning dislocation .... See Entry 119033

Beryllium fracture observed by in situ high voltage electron microscopy .... See Entry 119094

Influence of substrate deformations on interface structures. II. Experimental investigations for epitaxial Ag/Pd and Au/Pd bicrystals .... See Entry 119355

Influence of growth dislocations on low temperature conductivity in irradiated p-germanium .... See Entry 119616

Recent progress on LADA growth of HgCdTe and CdTe epitaxial layers .... See Entry 120244

Growth of low dislocation density CdTe films on hydroplaned CdTe substrates by molecular beam epitaxy .... See Entry 120252

Detection of thin intergranular cobalt layers in WC-Co composites by lattice imaging .... See Entry 120294

High-resolution electron microscopy of chemically vapor-deposited β-Si_3N_4-TiN composites .... See Entry 120308

Effects of metallurgical variables on hydrogen embrittlement in AISI type 316, 321 and 347 stainless steels .... See Entry 120415

Influence of rare earths on wrinkle formation in the scale of Fe-Cr-Al alloy .... See Entry 120504

Dissociation of *c* dislocations in sillimanite Al_2SiO_5 .... See Entry 121213

61.70L Slip, creep, internal friction and other indirect evidence of dislocations

(see also 62.20H Creep, 62.40 Internal friction)

119023 The photodamping of dislocations in KCl single crystals. M.A.Golosovskii, Ya.M.Soifer (Inst. of Solid State Phys., Acad. of Sci., Chernogolovka, USSR).
J. Phys. & Chem. Solids (GB), vol.44, no.10, p.991-7 (1983).
The effect of *F*-light ($\lambda=550$ nm) on the dislocation amplitude-dependent internal friction (dislocation photodamping) and dislocation charge in KCl crystals of different purity containing *F*-centers has been investigated. The photodamping process in all the crystals under study has been found to be due to the optical generation of new pinning points. The conditions of photopinner formation are found to depend on the magnitude of dislocation charge, the manner of the *F*-center introduction (γ-irradiation, additive coloration), and crystal purity. A model of photopinner formation has been proposed. The results obtained are used to analyse the binary systems in which the effect of dislocation photodamping is likely to occur. (14 refs.)

Beryllium fracture observed by in situ high voltage electron microscopy .... See Entry 119094

High-temperature internal friction peaks of pure aluminium .. See Entry 119100

Influence of defects on the diffusion of helium in calcium fluoride .... See Entry 119278

Dependence of photoluminescence on temperature in dislocated silicon crystals .... See Entry 120142

Pressure and temperature dependence of the mechanoluminescence of γ-irradiated alkali halide crystals .... See Entry 120169

61.70N Grain and twin boundaries

119024 EBIC characterization of electrically active defects in (Hg,Cd)Te. T.M.Moore, H.F.Schaake (Materials Sci. Lab., Texas Instruments Inc., Dallas, TX, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1666-8 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
A comparison of low temperature electron beam induced current imaging in the scanning electron microscope and surface defect etch studies has identified subgrain boundaries and isolated dislocations as electrically active recombination centers in *p*-type solid state recrystallized $(Hg_{1-x}Cd_x)Te$ with $X=0.3$. The 'spotty' appearance of these images is attributed to enhanced recombination at Te-rich precipitates decorating dislocations in the subgrain boundaries. (12 refs.)

119025 AES/STEM grain boundary analysis of stabilized zirconia ceramics. A.J.A.Winnubst (Twente Univ. of Technol., Dept. of Chem. Engng., Enschede, Netherlands), P.J.M.Kroot, A.J.Burggraaf.
J. Phys. & Chem. Solids (GB), vol.44, no.10, p.955-60 (1983).
Semiquantitative Auger electron spectroscopy (AES) on pure monophasic $(ZrO_2)_{0.83}(YO_{1.5})_{0.17}$ was used to determine the chemical composition of the grain boundaries. Grain boundary enrichment with Y was observed with an enrichment factor of about 1.5. The difference in activation energy of the ionic conductivity of the grain boundary compared with the bulk can be explained by the Y segregation. When Bi_2O_3 is introduced into this material and second phase appears along the grain boundaries of the cubic main phase. Energy dispersive X-ray analysis (EDS) on a scanning transmission electron microscope (STEM) shows an enrichment of bismuth at the grain boundaries of this second phase. (20 refs.)

119026 Grain boundaries structure in hexagonal crystal. P.Delavignette (CEN/SCK, Mol, Belgium).
J. Microsc. & Spectrosc. Electron. (France), vol.8, no.3, p.111-24 (1983). In French. (Meeting of the French and Belgian Societies for Electron Microscopy, Liege, Belgium, 16-19 May 1983).
A method is given for the analysis of coincidence grain boundaries in transmision electron microscopy. A formal expression is given for coincidence lattices, with a special application to the hexagonal system. A high precision method is given for the determination of all the characteristics of subgrain boundaries. A particular application of the method to the analysis of deformation twinning in hexagonal structures allowed a new approach of the different twinning modes in these structures. (11 refs.)

119027 Grain boundaries structure observed by high resolution electron microscopy. J.M.Penisson (CEA, Grenoble, France), C.D'Antertoches, J.Desseaux-Thibault, A.Bourret, A.Renault.
J. Microsc. & Spectrosc. Electron. (France), vol.8, no.3, p.125-34 (1983). In French. (Meeting of the French and Belgian Societies for Electron Microscopy, Liege, Belgium, 16-19 May 1983).
High resolution electron microscopy is used to study the atomic structure of some tilt grain boundaries in metals and semiconductors. The method itself is described and its limitations are shown. The main experimental results on $\Sigma=3$. $\Sigma=9$, $\Sigma=41$ in Si and Ge, and $\Sigma=41$ in molybdenum bicrystal are reviewed. (22 refs.)

119028 Electron diffraction study of symmetrical tilt boundaries in germanium. A.-M.Papon, M.Petit, G.Silvestre, J.-J.Bacmann (CENG., Grenoble, France).
J. Microsc. & Spectrosc. Electron. (France), vol.8, no.3, p.135-46 (1983). In French. (Meeting of the French and Belgian Societies for Electron Microscopy, Liege, Belgium, 16-19 May 1983).
The reciprocal lattice of the grain boundary zone of symmetrical tilt grain boundaries in germanium is investigated using electron diffraction technique. The diffraction from short grain boundaries arising from the decomposition of a $\Sigma=27$, and a detailed analysis of the diffraction patterns from the $\Sigma=9,11$ and 5 boundaries are presented. It is shown that grain boundary reflexions really exist and that, in correct conditions, its reciprocal lattice can be determined. The results from diffraction are also discussed in relation with those from other techniques in order to approach the grain boundary space group. (23 refs.)

119029 The study of grain boundary structure and properties in engineering materials. B.Ralph, A.Porter (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England).
J. Microsc. & Spectrosc. Electron. (France), vol.8, no.3, p.159-75 (1983). (Meeting of the French and Belgian Societies for Electron Microscopy, Liege, Belgium, 16-19 May 1983).
The importance of grain and phase boundaries in determining the physical and mechanical properties of crystalline materials is well established. However, a complete discription of the role of grain boundaries in influencing local microstructure is not simply achieved. Accurate data as to structural, crystallographic and chemical parameters are all required if a complete picture is to be formed. This review examines the various models of grain boundary structure available, and describes a number of recent experimental studies of boundary-sensitive properties in engineering materials. (67 refs.)

119030 Intergranular segregation and precipitation. L.Priester (Lab. de Metall. Phys., Univ. Paris-Sud, Orsay, France).
J. Microsc. & Spectrosc. Electron. (France), vol.8, no.3, p.211-32 (1983). In French. (Meeting of the French and Belgian Societies for Electron Microscopy, Liege, Belgium, 16-19 May 1983).
An attempt is made to present the current knowledge about intergranular segregation and precipitation in relation with equilibrium and non-equilibrium grain boundary structure. Recently, numerous theoretical studies on metals and oxides, have emphasized the link between segregation and structure on the basis of the polyhedral units model. Few works on the interaction between extrinsic dislocations and solutes are available, only on metals and from an experimental viewpoint; nevertheless, the important role of these defects as nucleation sites of a new intergranular phase has been recently underlined. The intergranular precipitation not only depends on inherent parameters of the grain boundary (structure and defects) but obviously on crystallographic relations between the grain boundary and the neighbouring crystals with regard to the orientation relationship between precipitate and matrix. In both cases, intergranular segregation and precipitation, an important problem to be solved is the occurrence of a hierarchy of structural influences. (65 refs.)

119031 Characterisation of grain boundaries in silicon by TEM and EBIC. C.Dianteill, A.Rocher (Lab. d'Optique Electronique, CNRS, Toulouse, France).
J. Microsc. & Spectrosc. Electron. (France), vol.8, no.3, p.233-42 (1983). In French. (Meeting of the French and Belgian Societies for Electron Microscopy, Liege, Belgium, 16-19 May 1983).
EBIC and TEM observations have been performed to establish a correlation between crystalline structure and electrical activity of grain boundaries in silicon. A correlation between the coherence of the grain boundary and the low electrical activity has been shown for the (221) $\Sigma 9$. Nevertheless some coherent grain boundaries can be electrically activated by heat treatment. (15 refs.)

119032 Mechanical twinning of $(TMTSF)_2ClO_4$ single crystal. T.Ishiguro, T.Ukachi, M.Tokumoto, K.Murata, K.Kajimura, H.Anzai (Electrotech. Lab., Ibaraki, Japan), K.Kato, G.Saito.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1063-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Mechanical kinks are formed in a needle crystal of $(TMTSF)_2ClO_4$ by applying stresses perpendicular to the needle axis. By X-ray precession photography, the authors have found that the kink is ascribed to the mechanical twinning with the boundary on the (210) plane. (6 refs.)

119033 Anomalous temperature dependence of the drag coefficient of a twinning dislocation. V.S.Boiko, V.F.Kivshik (Physicotech. Inst., Acad. of Sci., Kharkov, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.412-14 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.722-6 (March 1983). [received: Oct. 1983]
High-speed cinematography was used to study the dynamics of growth of a twin under a concentrated load and its emergence from a calcite crystal under the action of surface tension forces at temperatures 243-723K. The dislocation theory of the dynamic behavior of a twin was found to provide a satisfactory description of its behavior at high and low velocities. An analysis of the experimental data using relationships from this theory yielded the temperature dependence of the drag coefficient *B* of a twinning dislocation. The dependence was anomalous: instead of a rise of *B* on increase in temperature,

typical of the drag due to the interaction between a dislocation and elementary excitations of the lattice, there was an exponential fall. Such a temperature dependence $B(T)$ indicated that, in the investigated range of temperatures and velocities, the mechanism of the drag experienced by twinning dislocations involved relaxation processes in the medium stimulated by the motion of dislocations. The relaxation drag of twinning dislocations was assumed to represent the recovery of an orientational order disturbed locally near a moving twinning dislocation. The activation energy of the process, 0.086 eV, indicated that in calcite the relaxation process could be reorientation of CO_3 groups in the field of a moving dislocation. The proposed mechanism of the drag experienced by twinning dislocations could apply to orientationally ordered structures. (16 refs.)

Meeting of the French and Belgian Societies for Electron Microscopy ....See Entry 116921

An in situ slow extension rate fracture stage for Auger electron spectroscopy ....See Entry 117282

The symmetry of convergent-beam electron diffraction patterns from bicrystals ....See Entry 118827

On the identification of numerical simulation of contrasts visible in crystalline interfaces ....See Entry 118828

High-temperature internal friction peaks of pure aluminium ..See Entry 119100

Electrical conductivity of Sc_2O_3-ZrO_2 compositions by 4-probe DC and 2-probe complex impedance techniques ....See Entry 119260

Diffusion of water in NaCl bicrystals ....See Entry 119275

Experimental study of the electrical conductivity of the monocrystalline trioxide of molybdenum, MoO_3 ....See Entry 119598

Passivation of intragrain defects by copper diffusion in p-type polycrystalline silicon ....See Entry 119630

Diamagnetic anisotropy, isotope shift and cooling-speed effects in superconducting $(TMTSF)_2ClO_4$ crystals ....See Entry 119760

Role of grain boundaries in the trapping of a magnetic flux and in the change of plasticity during a superconducting-normal transition ....See Entry 119796

Intergranular segregation phenomena studied by AES ....See Entry 120194

Detection of thin intergranular cobalt layers in WC-Co composites by lattice imaging ....See Entry 120294

Cleaning effect of rare earths on grain boundary segregation in steels ....See Entry 120331

Microstructural characterization of doped dicalcium silicate polymorphs ....See Entry 120332

Microanalytical investigation of sintered SiC. II. Study of the grain boundaries of sintered SiC by high resolution Auger electron spectroscopy ....See Entry 120335

Intergranular segregation studies in steels using STEM-EDS X-ray microanalysis ....See Entry 120337

An AEM investigation of the formation of precipitate-free zones in an Al-16 wt.% Ag alloy: determination of equilibrium and metastable solvus lines ....See Entry 120339

Long-term ageing characteristics of Hastelloy alloy X ....See Entry 120341

Characterization of creep cavitation in sintered alumina by small-angle neutron scattering ....See Entry 120376

The effect of dissolved oxygen and NO_3^- anions on the stress corrosion cracking of type 304 stainless steel in water at 290 C ....See Entry 120493

61.70P Stacking faults, stacking fault tetrahedra and other planar or extended defects

119034 A new crystallographic shear structure in tin oxide. C.Kaito, T.Harada, T.Miyano (Dept. of Phys., Kyoto Tech. Univ., Kyoto, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L394-6 (July 1983).
Tin oxide crystals grown by electron beam irradiation of vacuum deposited amorphous films were investigated by a high resolution transmission electron microscopy (HRTEM) with the aid of computer simulation. A new type of ordered (110) CS structure with 1/2[110] shear and 1/2[110] glide were found in the reduced $Sn_{m+1}O_m$ crystals with $m=4$. (11 refs.)

119035 X-ray topographic observation of stacking fault in KCl. H.Hattori (Phys. Lab., Fukui Univ., Fukui, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3066-72 (Sept. 1983).
Two dimensional lattice defects in KCl crystal were observed by means of optical and X-ray topographic methods. The defects produced three types of diffraction images on X-ray topographs, that are the symmetric and asymmetric ones for $\pm\mathbf{g}$ of reciprocal lattice vectors, and the diffuse images for any $\mathbf{g}$. From the appear-disappear relation for various $\mathbf{g}$ and geometrical considerations, it was concluded that the defects are stacking faults, and the fault vector is nearly $a/6\langle 211\rangle$ which is anti-parallel to the Burgers vector of Shockley partial dislocation in an FCC structure. The stacking fault is accompanied by an expansion distortion perpendicular to the $\{111\}$ fault plane. The defects giving asymmetric or diffuse images are concluded to be formed by the superposition of simple stacking faults.

Mechanism of solid state transformations in single crystals of $Zn_xCd_{1-x}S$ ....See Entry 119180

Shear bands and the development of the brass annealing texture ....See Entry 120347

Can inherited textures in the BCC phase furnish information about the type of transformation from the FCC phase? ....See Entry 120350

Diffraction-contrast study of microstructure and deformation process of WC-Co cemented carbide ....See Entry 120370

Dissociation of *c* dislocations in sillimanite Al_2SiO_5 ....See Entry 121213

61.70R Crystal impurities: general

(see also 71.55 Impurity and defect levels; 81.10 Purification techniques)

119036 Crystal site location of dopants in semiconductors using a 100-keV electron probe. J.Tafto, J.C.H.Spence (Dept. of Phys., Arizona State Univ., Tempe, AZ, USA), P.Fejes.
J. Appl. Phys. (USA), vol.54, no.9, p.5014-15 (Sept. 1983).
The channeling effect on electron induced characteristic X-ray emission has been used to study the site occupancy of As in submicron regions of Si(3×10^{19} As atoms cm^{-3}). The authors report here the first absolute intensity measurements of the crystallographic orientation dependence of characteristic X-ray production by kilovolt electrons in order to determine quantitatively the crystal site occupancy of an impurity. (9 refs.)

119037 On the location of an absorbed hydrogen atom in aluminum metal. H.F.Ades, A.L.Companion (Dept. of Chem., Univ. of Kentucky, Lexington, KY, USA).
Solid State Commun. (USA), vol.48, no.4, p.337-40 (Oct. 1983).
Extended Huckel molecular orbital calculations indicate that a hydrogen atom absorbed in aluminum metal is bound in an off-center tetrahedral interstitial site adjacent to a vacancy, thus confirming previous jellium-based theoretical predictions and results of nuclear channelling experiments. The authors' work further indicates that these are the only stable internal sites for hydrogen atoms in an aluminum lattice. (21 refs.)

Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride ....See Entry 116917

Effects of nitrogen on dislocation behavior and mechanical strength in silicon crystals ....See Entry 119018

Effect of electric field on the lattice viscosity of doped displacive ferroelectrics ....See Entry 119122

Different kinds of Tl^{2+} charge compensation in thallium doped KH_2PO_4 and KD_2PO_4 crystals ....See Entry 119910

Structure and kinetics of some paramagnetic oxygen centres in synthetic calcium fluoride crystals ....See Entry 119914

Mossbauer study of the lattice location of ^{57}Co implanted in graphite ....See Entry 119961

61.70T Doping and implantation of impurities

119038 GaAs P-layer formation by Be ion implantation. S.Sugata, N.Tsukada, M.Nakajima, K.Kuramoto, Y.Mita (Optoelectronics Joint Res. Lab., Kawasaki, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L470-2 (July 1983).
A novel, nearly hazardless Be ion implantation technique has been realized by adopting BeO ceramic material as an ion source. This method made possible a continuous Be ion current of several tens of μA without noticeable contamination. High dose Be ion implantation experiments were carried out using this technique and it has been found that Be atom activation can be improved by hot implantation and subsequent lower temperature annealing. (9 refs.)

119039 Two different species of deuterium implanted into a pyrolytic graphite observed by XPS-SIMS. K.Ashida (Radio-isotope Lab., Toyama Univ., Toyama, Japan), K.Ichimura, K.Watanabe.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1465-8 (1983).
Trapped states of deuterium implanted into a pyrolytic graphite with 5 keV were investigated by means of the X-ray photoelectron spectroscopy and the secondary ion mass spectrometry. Chemical shift and broadening of C 1*s* peak were observed in the ZPS spectra due to deuterium-ion implantation at room temperature. The shift and the broadening increased with the deuterium fluence to reach constant values. In the SIMS spectra, CD^- and C_2D^- peaks appeared due to the deuterium implantation. The intensity of the CD^- peak increased with the fluence to reach a constant value, whereas that of the C_2D^- peak passed through a maximum to decrease to a constant value. A linear relation was observed between the chemical shift and the CD^- peak. The chemical shift and the CD^- peak disappeared after annealing the sample at 600°C for 5 min, whereas the broadening of the C 1*s* peak and the C_2D^- peak disappeared after annealing the sample at 900°C for 5 min. On the basis of these observations, it is concluded that at least two different species of the deuterium are formed in the graphite due to the deuterium implantation. (21 refs.)

119040 Annealing of $Hg_{1-x}Cd_xTe$: Hg loss rates and annealing of ion implantation damage. K.C.Dimiduk, W.G.Opyd, J.F.Gibbons, T.W.Sigmon (Stanford Electronics Labs., Stanford, CA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1661-5 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
An important problem in processing the infrared detector material $Hg_{1-x}Cd_xTe$ is avoiding undue mercury loss. Here the authors quantify that loss and apply the information to the annealing of ion implanted $Hg_{1-x}Cd_xTe$. They thus extend the work of Takita et al. on Hg loss in HgTe to the ternary $Hg_{1-x}Cd_xTe$. The Hg loss is generated with a thermal-pulse annealing system and measured by Rutherford backscattering spectrometry (RBS). The loss rate is studied as a function of temperature, composition, and surface preparation (chemimechanical and contactless polishing). For each set of conditions the data is fit to an Arrhenius equation $N_{\square}/t=A\exp(-\Delta E/kT)$ and the fitting parameters A and ΔE are determined. ΔE ranges from 1.0 to 2.5 eV and A varies from 10^{23} to 10^{36} atoms/cm^2 s. Channeling RBS was also used to study the effect of thermal pulse annealing on boron implanted material. The rate of change of the minimum yield (χ_{min}) with depth, which can be related to certain types of damage, was consistent with the calculated implant damage profile. A 260°C 8 s anneal restored the crystal quality to better than the as-received material, as observed by channeling. (16 refs.)

119041 Infrared rapid thermal annealing for GaAs device fabrication. H.Kohzu, M.Kuzuhara, Y.Takayama (Microelectronics Res. Lab., NEC Corp., Kawasaki, Japan).
J. Appl. Phys. (USA), vol.54, no.9, p.4998-5003 (Sept. 1983).
A new post-implantation annealing technique, called infrared rapid thermal annealing (IRTA), is discussed for fabricating GaAs devices using ion implantation technology. The IRTA apparatus and capless annealing conditions are described. Also, electrical property and its uniformity of *n* or n^+ type GaAs layers made by Si implantation to semi-insulating GaAs followed by IRTA are presented, and compared with those made by Si_3N_4 capped furnace annealing. A steeper carrier concentration profile with a higher peak carrier concentration in the *n* type active layer made by IRTA results in a higher transconductance without any anomalous characteristics on the GaAs metal-semiconductor field-effect transistor. (13 refs.)

119042 Doping kinetics of polyacetylene in the short range. E.Cernia, L.D.D'Ilario, E.Ferretti, G.Nencini (Assoreni, Rome, Italy).
J. Phys. Colloq. (France), vol.44, no.C-3, p.167-70 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The kinetics of doping with iodine of polyacetylene (PA) films, synthesized by the Shirakawa technique, (1974) have been investigated by measuring the variation of electrical conductivity and IR absorbance at 1400, 1023 and 750 cm^{-1} within the time range of the first minute of doping. The experimental data suggest that the doping process occurs within at least three steps whose rate constants differ by orders of magnitude. An attempt is made to elaborate

a kinetic model for the doping process and the activation energies are calculated. (14 refs.)

119043 Iron (III) perchlorate doping of polyacetylene. J.R.Reynolds, J.C.W.Chien, F.E.Karasz (Dept. of Polymer Sci. & Engng., Univ. of Massachusetts, Amherst, MA, USA), C.P.Lillya, D.J.Curran.
J. Phys. Colloq. (France), vol.44, no.C-3, p.171-4 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Free standing films of polyacetylene have been oxidized with $Fe(ClO_4)_3$ to yield materials exhibiting high electrical conductivity thus providing an alternative route to the electrochemical p-doping with perchlorate anion. (8 refs.)

119044 Stability of polyacetylene doped by ion implantation. J.Davenas, X.L.Xu (Dept. de Phys. des Materiaux, Villeurbanne, France), M.Maitrot, M.Gamoudi, G.Guillaud, J.J.Andre, B.Francois, C.Mathis.
J. Phys. Colloq. (France), vol.44, no.C-3, p.183-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The introduction of doping impurities in polymers such as $(CH)_x$ can induce n or p type semiconducting properties or a metallic regime when increasing the concentration. The authors present some new results on the stability of $(CH)_x$ films doped by ion implantation, with respect to: (1) the degradation induced by the ionic irradiation, (2) oxidation, (3) thermal annealings. For that purpose two types of techniques have been used: (1) modification of the electrical conductivity and (2) nuclear microanalysis for depth profiling of the different elements. In particular the nuclear resonance at 6385 keV of ^{15}N was used to determine the hydrogen composition of the matrix as a function of the depth. The repartition of the different doping species and the evolution with annealings was studied by Rutherford backscattering spectroscopy (RBS). (12 refs.)

119045 Doping of $(CH)_x$ films with lanthanides salts. D.Boils, F.Schue, J.Sledz (Lab. de Chimie Macromoleculaire, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.189-92 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Studies on polyacetylene doped with $MoCl_5$, SbF_5, have shown, first, that during desorption under vacuum weight decrease of the samples was low; second, that these compounds induce a stabilization of the polyacetylene in what concerns the conductivity. The authors have extended these studies to rare earth salts to see their eventual stabilization effect on polyacetylene. (3 refs.)

119046 Features of defect formation during ion implantation and during post-implantation annealing of semiconductor A^3B^5 compounds. Yu.A.Danilov, S.K.Maksimov, P.V.Pavlov.
Radioelectron. & Commun. Syst. (USA), vol.25, no.7, p.98-100 (1982). Translation of: *Izv. VUZ Radioelektron. (USSR)*, vol.25, no.7, p.88-9 (1982). [received: Oct. 1983]
The formation of defects during ion doping and annealing has only been investigated for silicon, although even in this case there is still a number of unsolved problems. There are no review papers on the formation of defects in A^3B^5 materials. The authors compare the features of the defect structure during ion implantation and post-implantation annealing for gallium arsenide and indium antimonide. (6 refs.)

119047 Radiation damage and near-edge optical properties of ion-implanted gallium arsenide. W.Wesch, W.Wilk, K.Hehl (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.65-70 (1983). In English.
Measurements of optical transmission and Rutherford backscattering experiments (RBS) were carried out to investigate the correlation between different defect structures and the near edge optical properties of ion implanted GaAs. Photon-energy as well as dose dependence of the near edge absorption coefficient K can be described by superposition of two exponential functions with characteristic energies E_1 and E_2 which characterize the states of weakly damaged and amorphous layers. The results indicate the existence of two basic absorption processes in ion implanted GaAs. (11 refs.)

119048 Chemical etching behaviour of ion-irradiated SiO_2. J.Mittenbacher, E.Sennewald, B.Wiedemann (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.71-5 (1983). In English.
Damage of thermally grown SiO_2 by ion implantation enhances the dissolution in acidic fluoride solutions. Depth profiles of the etching rate agree with theoretical calculations of the energy deposition into atomic displacements. The influence of the chemical nature of the most usual dopants B and P on the etching behaviour is interpreted in terms of the molar composition of the etchants. (11 refs.)

Ion-implanted waveguides .... See Entry 118273

P_{Ga} antisite defect in Zn-implanted $GaAs_{0.1}P_{0.9}$ LED .... See Entry 119016

Lateral spreads of Be and Si in GaAs implanted with a maskless ion implantation system .... See Entry 119051

Some aspects of Li behavior in ion implanted HgCdTe .... See Entry 119052

Strengthening of GaAs by impurity atom-vacancy complexes .... See Entry 119054

Pulse radiation annealing of capless GaAs .... See Entry 119055

A review of laser beam applications for processing silicon .... See Entry 119059

Thermal stability of electrically active dopants in laser annealed silicon films .... See Entry 119060

Annealing of implanted silicon under the action of microsecond pulsed TEA-CO_2 laser radiation .... See Entry 119064

Diagnostics of the elastic properties of quartz and glass surfaces during ion implantation .... See Entry 119327

Growth kinetics of platinum silicide .... See Entry 119360

Doping of $(CH)_x$ films with metal penta- and hexafluorides .... See Entry 119555

Amorphous silicon-phosphorus layer .... See Entry 119613

Passivation of intragrain defects by copper diffusion in p-type polycrystalline silicon .... See Entry 119630

Carrier depletion in sulfur doped epitaxial GaAs layer by boron ion implantation .... See Entry 119721

A study on the purity and SIMS profiling of MOVPE-cadmium mercury telluride .... See Entry 119723

Instabilities in the superconductivity and the resistivity of implanted $Pd_{1-y}Cu_yH_x$ thin layers .... See Entry 119751

The effects of ion-implantation damage on the first-order Raman spectra of GaP .... See Entry 120044

Doping and degradation of polyacetylene by nitric acid .... See Entry 120054

Characterisation of silicon crystals by means of photoluminescence measurements .... See Entry 120153

A linear analysis of chemical vapour deposition processes for micro-electronics applications. I. Diffusive gas transport .... See Entry 120260

A mechanism for the effect of doping on the silicon native oxide thickness .... See Entry 120474

61.70W Impurity concentration, distribution, and gradients

(see also 66.30J Diffusion, migration and displacement of impurities)

119049 Depth profile of hydrogen in thin films with elastic recoil detection technique. Cheng Huansheng, Zhou Zhuying, Xu Zhiwei, Ren Yiehua, Yang Fujia (Fudan Univ., Shanghai, China).
Chin. J. Nucl. Phys. (USA), vol.5, no.3, p.203-10 (Aug. 1983). In Chinese.
An elastic recoil detection technique for the depth profile measurement of hydrogen in thin films by using a Van de Graaff accelerator is described. $^4He^+$ ions of energy 2.1 MeV are used on the target tilted at an angle of 75°. The energy analysis of H forward scattered yields a depth resolution of ≤ 500 Å near the surface regions and a sensitivity of 0.1 at.% for ^1H to depths of ≤ 0.5 μm in solids. This method has been used for the depth profile measurement of hydrogen in plasma deposited a-Si and silicon nitride films with combined Rutherford backscattering and nuclear reaction $^{16}O(d,p)^{17}O$ techniques. The relations between the quantity of hydrogen in a-Si and substrate temperature are presented. (11 refs.)

119050 Analysis of hydrogen concentration and its depth profile in solid with detection of H(d,p) recoil. Guo Qingjiang, Yang Zhuqing, Lu Xiuqin, Zhao Kui, Cheng Yehao, Han Shukui, Yu Quan, Jiang Chenglie (Inst. of Atomic Energy, Acad. Sinica, Beijing, China).
Chin. J. Nucl. Phys. (USA), vol.5, no.3, p.211-16 (Aug. 1983). In Chinese.
A method of analyzing the hydrogen content in solid material using recoil detection in H(d,p) scattering induced by low energy deuteron is described. The sensitivity of this method is 200 ppm for silicon specimen. The depth resolution is about 0.28 μm and the maximum depth which can be measured is 1.5 μm. (8 refs.)

119051 Lateral spreads of Be and Si in GaAs implanted with a maskless ion implantation system. E.Miyauchi, H.Arimoto, Y.Bamba, A.Takamori, H.Hashimoto, T.Utsumi (Optoelectronics Joint Res. Lab., Kawasaki, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L423-5 (July 1983).
Submicron Si and Be ion beams have been implanted into GaAs using a 100 kV maskless ion implantation system with a liquid metal ion source which is capable of emitting double ion species (Si^{++} and Be^{++}). Both ion beams are implanted at 160 keV with the dose of 10^{12} to 10^{15} cm^{-2}. The profiles of the implanted dopants have been estimated by observing the stain etching patterns on the cleaved planes before and after annealing. It has been found that high dose implantation results in a considerable lateral impurity spread of 1 μm or more, even with the focused ion beams having a diameter of 0.1 μm. However, doping of submicron width can be realized with relatively low doses or with shallow implantation. (8 refs.)

119052 Some aspects of Li behavior in ion implanted HgCdTe. L.O.Bubulac, W.E.Tennant, R.A.Riedel, J.Bajaj, D.D.Edwall (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1646-50 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
SIMS has been used on both unimplanted and B-ion implanted LPE grown HgCdTe to study the distribution of the Li impurity background. In unimplanted layers Li decorates some types of crystal defects and also reflects the *p/n* distribution in the layer. In implanted layers Li decorates the implantation-induced damage and also reveals the junction region. Ion implanted junctions have been evaluated by Hall, differential Hall, EBIC, *C-V*, and TEM techniques and the results correlated with the features exhibited by the Li distribution. The Li distribution analysis reinforces the previous understanding that implanted junctions are several microns deep, n^+/p^-, graded in the *p* region and formed by implant-induced native donors. (16 refs.)

Determination of p-n junctions in InP/GaInAsP laser heterostructures using a profilometer .... See Entry 118146

Precision interplanar spacing measurements of boron-doped silicon .... See Entry 118958

Stability of polyacetylene doped by ion implantation .... See Entry 119044

Thermal stability of electrically active dopants in laser annealed silicon films .... See Entry 119060

Oxidation enhanced and concentration dependent diffusions of dopants in silicon .... See Entry 119271

Examination of models for Zn diffusion in GaAs .... See Entry 119272

Carrier depletion in sulfur doped epitaxial GaAs layer by boron ion implantation .... See Entry 119721

A study on the purity and SIMS profiling of MOVPE-cadmium mercury telluride .... See Entry 119723

Identification of residual donors in high-purity epitaxial GaAs with the use of magneto-optical spectroscopy .... See Entry 120035

Determination of the nitrogen doping of liquid phase epitaxy GaP and $Ga_xIn_{1-x}P$ alloys by optical absorption and photoluminescence .... See Entry 120114

Deep-level luminescence in Ni-diffused GaAs .... See Entry 120125

Secondary ion mass spectroscopy applications in semiconductor technology: III-V compound and other material structures .... See Entry 120213

High-purity InP grown by hydride VPE technique with impurity gettering by indium source and oxygen .... See Entry 120258

A mechanism for the effect of doping on the silicon native oxide thickness .... See Entry 120474

Measurement of impurities in a multi-doped sample of cadmium mercury telluride .... See Entry 120702

61.70Y Interaction between different crystal structure defects

119053 Vacancy-impurity binding energy and the effective vacancy formation energy as determine from the solidus line for binary Al-based alloys. T.Gorecki (Phys. Lab., Higher School of Engng., Opole, Poland).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.801-3 (Sept. 1983).
The vacancy model of melting of metals has been used as a starting point for deriving the expressions permitting the determination of the vacancy-impurity binding energy, E_{v-i}^{b}, and the effective vacancy formation energy from the knowledge of the solidus line for binary alloys. The calculated values of E_{v-i}^{b} and E_{v}^{e} for binary Al-based alloys show a fair agreement with the experimental data existing in the literature. (36 refs.)

119054 Strengthening of GaAs by impurity atom-vacancy complexes. O.K.Gorodnichenko, E.A.Glushkov, V.F.Kovalenko, N.D.Vasilenko (Odessa State Univ., Odessa, USSR).
Phys. Status Solidi a (Germany), vol.79, no.1, p.331-5 (Sept. 1983).
Measurements are made of flow limits and photoluminescence spectra of n- and p-GaAs deformed by uniaxial tension. It is shown that long-wave radiation bands of higher intensity correspond to higher flow limit values, the intensity rising is due to an increase in the concentration of impurity atom-vacancy complexes ($Te_{As}V_{Ga}$, $Sn_{As}V_{Ga}$, etc.). The data obtained are proved by calculations made according to the model of strengthening the crystals by complexes. It is noted that in p-GaAs no complexes are found and its flow limit is lower than that in crystals having electron-type conductivity. (17 refs.)

Effects of nitrogen on dislocation behavior and mechanical strength in silicon crystals ..... See Entry 119018

Structure and kinetics of some paramagnetic oxygen centres in synthetic calcium fluoride crystals ..... See Entry 119914

Dissociation of *c* dislocations in sillimanite Al_2SiO_5 ..... See Entry 121213

61.80 RADIATION DAMAGE AND OTHER IRRADIATION EFFECTS

(for techniques of structure determination, see 61.10 to 61.16; for electron and ion impact phenomena, see 79.20)

119055 Pulse radiation annealing of capless GaAs. J.Grno, S.Bederka, M.Vesely (Dept. of Microelectronics, Slovak Tech. Univ., Bratislava, Czechoslovakia).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K41-4 (Sept. 1983).
The purpose of semiconductor sample annealing after implantation is to repair the disturbed crystallographic structure and to activate electrically the dopants in the implanted region. The authors investigate the effect of radiation pulse annealing by halogen lamps on the dissociation of GaAs surface layers. (3 refs.)

119056 Bending of an infinitely long rectangular wire in conditions of radiation-induced creep and swelling. I.S.Kulikov, B.E.Tverkovkin, L.N.Shegidevich.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.28-33 (1983). In Russian.
A method and mathematical program are given for calculating the bend of a sufficiently thin plate under swelling and irradiation creep conditions. (8 refs.)

119057 Pulse heating regimes in semiconductors induced by irradiation. H.-D.Geiler (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.57-63 (1983). In English.
The manipulation of thermally activated processes by pulse-heating of semiconductors up to temperatures near the melting point has a growing importance for manufacturing integral circuits. The pulse regimes are derived from the consideration of the energy transport in a wafer subjected to a pulse irradiation. A classification of the process regimes is given by estimating the effect of characteristic thermally activated processes. For such a process in a semiconducting wafer it is then possible to select the parameters of the energy pulse and to choose the experimental equipment, inclusive of the working mode, by taking into consideration the possibilities of technical realization. (15 refs.)

Radiation-optical properties of quartz glass fiber-optic waveguides (review) ..... See Entry 118293

Chemical nature of irradiation defects in some TCNQ salts ..... See Entry 119006

Effect of UV illumination on the sublimation of basal surfaces of zinc oxide ..... See Entry 119167

Anomalous microwave induced step behaviour in Josephson tunnel junctions ..... See Entry 119771

Preparation and properties of high quality polyacetylene ..... See Entry 120053

Effect of post-irradiation deformation on thermoluminescence spectra of KCl:Ca and NaCl:Ca crystals ..... See Entry 120161

61.80B Laser beams

119058 Laser damage to transparent polymers in sharply focused single-mode beams. A.A.Manenkov, V.S.Nechitailo, A.S.Tsaprilov (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.173-5 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.,* vol.44, no.8, p.1770-3 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
Presents a detailed investigation of laser damage to polymers in sharply focused beams. The method of investigation was based on study of the morphology of the damage, the space-time characteristics of the emitted light, and the accumulation effect, which is a test for the influence of absorbing defects. The most characteristic representation of the clear plastics—specially purified polymethyl methacrylate (PMMA) and modified polymethyl methacrylate (MPMMA) with damage thresholds near that of K-8 silicate glasses—were chosen as objects for study. (5 refs.)

119059 A review of laser beam applications for processing silicon. I.W.Boyd (Dept. of Phys., North Texas State Univ., Denton, TX, USA).
Contemp. Phys. (GB), vol.24, no.5, p.461-90 (Sept.-Oct. 1983).
The field of laser processing has expanded rapidly in recent years to become one of the most prolific areas in research in applied physics. This is mainly due to the novel conditions presented by typical laser treatments which have allowed previously unexplored regimes of material processing to be readily achieved. The author reviews the present status of research in the area of laser processing of silicon in its different forms and under various conditions which offer the prospect of important advances in microelectronics fabrication and crystal growth in general. The principal features of the more common modes of laser processing will be described, in conjunction with the widely accepted interpretations of their associated kinetics. The present controversy regarding the behavior of silicon under intense laser excitation has stimulated much theoretical interest in the subject, and this has additionally helped to bring about a better understanding of many related physical phenomena. (69 refs.)

119060 Thermal stability of electrically active dopants in laser annealed silicon films. S.R.Wilson, W.M.Paulson, R.B.Gregory, G.Tam (Semiconductor Res. & Dev. Labs., Motorola Inc., Phoenix, AZ, USA), C.W.White, B.R.Appleton, A.K.Rai, P.P.Pronko.
J. Appl. Phys. (USA), vol.54, no.9, p.5004-13 (Sept. 1983).
Single crystal Si wafers and polycrystalline Si films on Si_3N_4 have been implanted with large doses ($1\times10^{15}/cm^2$-$4\times10^{16}/cm^2$) of P or As and laser annealed with either a CW or pulsed laser. The samples were then subjected to thermal anneals between 450 and 900°C to determine the thermally stable dopant concentration for each sample. Sheet resistance and Hall measurements have been used to measure the electrical properties in each case. SIMS, RBS, and TEM have been used to measure atomic profiles, As substitutionality and residual defects after laser and thermal annealing. In each case the maximum electrically active dopant concentration achieved by laser annealing decreased after a 700-800°C thermal anneal. (23 refs.)

119061 Theoretical considerations regarding pulsed laser annealing of a-Ge layers on GaAs. A.Bhattacharyya (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA), B.G.Streetman.
J. Phys. D (GB), vol.16, no.10, p.2033-7 (14 Oct. 1983).
The thermal melting model has been widely used to explain the liquid phase epitaxial regrowth during pulsed laser annealing of ion implanted semiconductors. The authors present results of similar calculations regarding regrowth of epitaxial heterojunctions such as the Ge-GaAs system. They calculate the Nd:glass laser ($\lambda=1.06$ μm) fluences necessary to melt various thicknesses of the a-Ge layer and study the regrowth velocity. The high solidification rates can be used to produce metastable alloys which are conventionally produced by vapour phase quenching of nonthermal species. (13 refs.)

119062 Pulsed-laser annealing of GaAs surface studied by time-resolved second-harmonic generation in reflection. S.A.Akhmanov, N.I.Koroteev, G.A.Paitian, I.L.Shumay (Dept. of Phys., Moscow State Univ., Moscow, USSR), M.F.Galjautdinov, I.B.Khaibullin, E.I.Shtyrkov.
Opt. Commun. (Netherlands), vol.47, no.3, p.202-4 (1 Sept. 1983).
Experimental results are presented on the time dependence of the second-harmonic generation (SHG) of a mode-locked *Q*-switched Nd:YAG laser in reflection from both amorphous and crystalline GaAs surfaces during the pulsed-laser annealing under ruby laser irradiation. A dramatic increase of SHG for more than two orders of magnitude due to recrystallization of the noncentrosymmetric GaAs lattice in the process of pulsed-laser annealing is observed and the duration of surface recrystallization is measured to be not greater than 30-40 ns. The results can be fully understood in terms of the melting model of laser annealing. (10 refs.)

119063 Photostimulated diffusion in semiconductors. T.D.Dzhafarov (Inst. of Phys., Acad. of Sci., Baku, Azerbaidzhan SSR).
Phys. Status Solidi a (Germany), vol.79, no.1, p.11-45 (Sept. 1983).
Reviews results of theoretical and experimental works, dedicated to the research on photostimulated processes (mainly diffusion, formation of defects, annealing of defects) in crystalline and amorphous semiconductors and their structures. (69 refs.)

119064 Annealing of implanted silicon under the action of microsecond pulsed TEA-CO_2 laser radiation. L.Nanu, D.Barbulescu, V.Mihailescu, V.Teodorescu, L.C.Nistor (Central Inst. of Phys., Bucharest, Rumania).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K5-8 (Sept. 1983).
A great interest arose in the last few years by the recrystallization of amorphous layers on the top surface of implanted semiconductor materials under the action of poweful laser radiation. The CW or pulsed laser irradiation actually results in either a solid-phase epitaxial regrowth or a liquid-phase process, respectively, depending on the temporal characteristics of the incident power. New results on annealing of implanted silicon samples, under the action of microsecond pulsed CO_2 laser radiation, are firstly reported. (9 refs.)

119065 Laser-induced damage in solids. Ramli bin Jaya.
Univ. Wales, Swansea thesis, March 1983
The author presents a study of the mechanisms involved in causing damage to optical components irradiated by 10.6 μm, 300 nsec flashes of infrared radiation from a single transverse mode carbon dioxide laser. Electron-microphotographs of the damage sites have been obtained for NaCl, KCl, Ge and GaAs and are used to describe the nature of the damage formation.

Review of laser induced damage thresholds ..... See Entry 118182

Laser induced damage in the ultraviolet ..... See Entry 118185

Effects of multiple interaction in laser damage to optical materials ..... See Entry 118192

A model for laser induced diffusion ..... See Entry 119242

Generation, investigation and application of laser-induced charge carrier plasmas in semiconductors ..... See Entry 119642

Raman scattering, defect luminescence, and phonon spectra of ^{7}LiH, ^{6}LiH, and ^{7}LiD crystals ..... See Entry 120088

Characterisation of silicon crystals by means of photoluminescence measurements ..... See Entry 120153

Optical properties of laser-melt-quenched Au-Si alloys ..... See Entry 120173

61.80C X-rays

Ionic and electronic processes during Frenkel defect annealing in KBr crystals above LHeT ..... See Entry 119012

Paramagnetic impurity centers in single crystals of synthetic xenotime ..... See Entry 119908

Structure and kinetics of some paramagnetic oxygen centres in synthetic calcium fluoride crystals ..... See Entry 119914

X-ray induced luminescence in crystalline SiO_2 ..... See Entry 120128

Optical absorption and thermoluminescence of bismuth-doped NaCl single crystals irradiated with X-rays ..... See Entry 120158

Thermoluminescence of thallium-doped BaFCl ..... See Entry 120162

The field fluctuational model of thermally stimulated processes in ferroelectric $LiNbO_3$ ..... See Entry 120167

61.80E Gamma rays

119066 ^{60}Co γ-ray and electron irradiation damage of GaAs single crystals and solar cells. M.Yamaguchi, C.Amano (Ibaraki Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Ibaraki, Japan).
J. Appl. Phys. (USA), vol.54, no.9, p.5021-9 (Sept. 1983).
^{60}Co γ-ray and high energy electrons (0.8-4 MeV) irradiation damage of GaAs solar cells were examined. Changes in minority carrier diffusion length in irradiated GaAs single crystals were also investigated by electron beam and ^{60}Co γ-ray-induced current methods for solar cells. Damage constant of *p*-GaAs is smaller than that of *n*-GaAs. Equivalent damage rate in GaAs due to electron irradiation to ^{60}Co γ-ray irradiation damage was clarified experimentally and theoretically. Experimental results for radiation damage of GaAs solar cells were also in satisfactory agreement with theoretical values, calculated from change in minority carrier diffusion length due to irradiation. Radiation damage in GaAs solar cells can be evaluated by using radiation damage data in GaAs single crystals. In-depth profiles for electron irradiation damage in GaAs and annealing behavior of radiation damage in GaAs were also examined. (17 refs.)

119067 Effect of γ-radiation on the electrical properties of bulk amorphous $As_4Se_2Te_4$. M.H.El-Fouly, A.Z.El-Behay, S.A.Fayek (Nat. Centre for Radiation Res. & Technol., Atomic Energy Establ., Cairo, Egypt).
Radiat. Phys. & Chem. (GB), vol.19, no.1, p.57-61 (1982). [received: Oct. 1983]
The effect of γ-radiation on the electrical properties of bulk amorphous $As_4Se_2Te_4$ was studied in the temperature range from 330K down to 100K. The material was irradiated at room temperature and at annealing temperature (T_A) slightly less than the glass transition temperature. Absorbed doses at room temperature as high as 100 Mrad showed no effect on the electrical properties of the material all over the range of temperatures 100-330K. The relation between $\ln \sigma$ and $1/T$ of the samples irradiated under annealing temperature (T_A) showed lower activation energy and higher conductivity at temperatures below room temperature. There was a marked dependence between the conductivity of the irradiated material under annealing temperature and the absorbed radiation dose. (9 refs.)

γ-ray irradiation effect on transmission loss for ZrF_4-based optical fibres .... See Entry 118284

Change of conduction mechanism with gamma dose of irradiated borosilicate glasses containing copper ions .... See Entry 119261

Influence of growth dislocations on low temperature conductivity in irradiated p-germanium .... See Entry 119616

NMR measurement of entanglement density in irradiated polyisobutylene .... See Entry 119946

Effect of γ-irradiation on the thermoluminescence of phosphorescent zinc sulphide .... See Entry 120157

Thermoluminescence of thallium-doped BaFCl .... See Entry 120162

Pressure and temperature dependence of the mechanoluminescence of γ-irradiated alkali halide crystals .... See Entry 120169

61.80F Electrons and positrons

119068 A study on electron injection in KBr single crystal. A.K.Maiti, K.Goswami, A.K.Lahiri (Dept. of Phys., Jadavpur Univ., Calcutta, India).
Fizika (Yugoslavia), vol.15, no.3, p.247-53 (July-Sept. 1983).
A crystal of KBr is coloured by means of electron injection under elevated temperatures and applied voltages. The growth of space charge limited (*SCL*) current and colouration have been studied and the efficiency of *F* centre formation in *SCL* region was found to be anomalous near 748K. The roles of temperature and the injection voltage for the production of trapping centers have been discussed. (8 refs.)

119069 Radiation-induced mobility of lithium and sodium in alpha-quartz. K.B.Hitt, J.J.Martin (Dept. of Phys., Oklahoma State Univ., Stillwater, OK, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5030-1 (Sept. 1983).
The radiation-induced release of the charge compensating ions Li^+ and Na^+ from the substitutional aluminum impurity in α-quartz has been investigated by measuring the growth of the infrared active $Al\text{-}OH^-$ center as a function of sample temperature during irradiation. It was found that Li^+ is released 10-15K lower in temperature than Na^+. (10 refs.)

119070 Carbon-related vibronic bands in electron-irradiated silicon. G.Davies, E.C.Lightowlers, M.do Carmo (Wheatstone Phys. Lab., King's Coll., London, England).
J. Phys. C (GB), vol.16, no.28, p.5503-15 (10 Oct. 1983).
Detailed measurements are presented for four independent optical centres with zero-phonon lines at 951.16, 952.98, 953.96 and 956.91 meV which are observed in 2 MeV electron-irradiated carbon-doped silicon. Uniaxial stress perturbations and carbon and silicon isotope effects are all shown to be very similar for these four centres and for the well known 969.45 meV centre, implying that all these centres are minor modifications of each other. A re-examination of the 969.45 meV vibronic sidebands observed in luminescence and absorption. (14 refs.)

Crystal site location of dopants in semiconductors using a 100-keV electron probe .... See Entry 119036

^{60}Co γ-ray and electron irradiation damage of GaAs single crystals and solar cells .... See Entry 119066

Average energy loss of 24.8-MeV electrons after passing through and backscattering from thick layers of C, Al, Cu, and Pb .... See Entry 119075

Studies of structural transitions in TMA-TCNQ-I by high voltage electron diffraction .... See Entry 119177

Charge density wave domains in irradiated 1T-TaS_2: relation with the transport properties .... See Entry 119485

Annealing of electron-induced defects in *n*-type germanium .... See Entry 119510

Electrical properties of an irradiated methyl-pyridinium-TCNQ salt .... See Entry 119581

Photoinduced absorption study of recombination in amorphous Si:H doped with P or B .... See Entry 119631

Photoionization cross section of electron irradiation induced levels in silicon .... See Entry 119648

Thermally stimulated current of crosslinked polyethylene by electron beam irradiation .... See Entry 119973

Comparison of fast electron and thermal annealing of proton bombarded silicon-X-ray and IR spectroscopy study .... See Entry 120083

Boron impurity anti-site defects in p-type gallium-rich gallium arsenide .... See Entry 120116

61.80H Neutrons

The investigation of the behaviour of an elastic-plastic thick-walled tube under irradiation .... See Entry 118439

Defect symmetry from stress transient spectroscopy .... See Entry 119507

Destruction of the gap in the intermediate valence compound SmB_6 by neutron irradiation .... See Entry 119522

The effect of atomic order on the superconducting properties of A-15 Nb_3Au and $Nb_3Au_{1-x}Pt_x$ alloys .... See Entry 119749

61.80J Ions

(for ion implantation, see 61.70T)

119071 Radiation damage in epitaxial CaF_2 films on Si substrates by Ar^+ ion implantation. H.Ishiwara, K.Orihara, T.Asano (Graduate School of Sci. & Engng., Tokyo Inst. of Technol., Yokohama, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L458-60 (July 1983).
Radiation damage in epitaxial CaF_2 films on Si substrates produced by 150 keV Ar^+ ion implantation has been investigated using Rutherford backscattering and channeling techniques. It has been found that CaF_2 films are more stable than Si crystals for ion bombardment and are not amorphized at such a high dose as 6×10^{16} cm^{-2}. Recovery of the damage by subsequent thermal annealing has also been investigated. (8 refs.)

119072 Damage production in GaAs by H^+ irradiation. R.S.Bhattacharya (Universal Energy Systems Inc., Dayton, OH, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5039-42 (Sept. 1983).
Rutherford backscattering and proton induced X-ray emission in combination with channeling have been used to study damage production in GaAs by proton irradiation. The average cross section for displacement of Ga and As atoms has been determined and found to agree well with the cross section calculated from the elastic displacement theory of Kinchin and Pease. In addition, the authors have demonstrated that about 6% more Ga atoms are displaced than As atoms. (16 refs.)

119073 Kinetics of radiation-induced segregation in Ni-12.7 at.% Si. R.S.Averback, L.E.Rehn, W.Wagner, H.Wiedersich, P.R.Okamoto (Materials Sci. Div., Argonne Nat. Lab., Argonne, IL, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3100-9 (15 Sept. 1983).
The kinetics of radiation-induced segregation in Ni-12.7 at.% Si alloys was investigated using in situ, simultaneous Rutherford-backscattering spectrometry. It was observed that a precipitate layer of γ'-Ni_3Si grew at the specimen surface during 2.0-MeV He and 2.75-MeV Li irradiations. The thickness of the γ' layer was measured as a function of dose, dose rate, and temperature. For all of the irradiation conditions the γ' layer thickness grew proportionately to the square root of dose. The proportionality constant, or growth-rate constant, was dependent on temperature and dose rate. Below ~750°C the growth-rate constant displayed Arrhenius behavior with an apparent activation enthalpy of 0.30 ± 0.04 eV, and it depended approximately in the $-^1/_4$th power of the dose rate. Above 590°C the growth-rate constant also displayed Arrhenius behavior but with an apparent activation enthalpy of -0.75 ± 0.15 eV; moreover, it was independent of dose rate in this temperature regime. A simple model for radiation-induced segregation is described which relates the segregation results to high-temperature point-defect properties in alloys. It shows that the apparent activation enthalpy of the growth-rate constant at low temperatures is equal to $^1/_4$ the enthalpy of vacancy migration, and that at high temperatures it is equal to $-^1/_2$ the enthalpy of vacancy formation. The model also correctly predicts the observed dose-rate dependences of the growth-rate constant in the two temperature regimes. (24 refs.)

Annealing of $Hg_{1-x}Cd_xTe$: Hg loss rates and annealing of ion implantation damage .... See Entry 119040

Features of defect formation during ion implantation and during post-implantation annealing of semiconductor A^3B^5 compounds .... See Entry 119046

Radiation damage and near-edge optical properties of ion-implanted gallium arsenide .... See Entry 119047

The effects of ion-implantation damage on the first-order Raman spectra of GaP .... See Entry 120044

Comparison of fast electron and thermal annealing of proton bombarded silicon-X-ray and IR spectroscopy study .... See Entry 120083

Raman scattering, defect luminescence, and phonon spectra of ^{7}LiH, ^{6}LiH, and ^{7}LiD crystals .... See Entry 120088

61.80L Atoms and molecules

New experimental investigations of the density effect on inner-shell excitation and energy loss .... See Entry 117976

61.80M Channelling, blocking and energy loss of particles

(see also 29.70 Energy loss and range relations)

119074 Monte-Carlo calculations of keV electron and positron slowing down in solids. S.Valkealahti, R.M.Nieminen (Dept. of Phys., Univ. of Jyvaskyla, Jyvaskyla, Finland).
Appl. Phys. A (Germany), vol.A32, no.2, p.95-106 (Oct. 1983).
A Monte-Carlo simulation technique based on the screened Rutherford differential cross section for the elastic scattering and Gryzinski's semiempirical expression for the inelastic core and valence electron excitation is used to describe electrons and positrons slowing down in solids. The theoretical results are compared with the experimental backscattering, absorption and transmission results for aluminum, silicon, copper, and gold thin film and semi-infinite targets and good agreement is observed. The simulated stopping profiles are fitted with a simple analytic expression. The profiles are Laplace-transformed to give a useful data base for analyzing phenomena associated with slow positron re-emission from solids. (22 refs.)

119075 Average energy loss of 24.8-MeV electrons after passing through and backscattering from thick layers of C, Al, Cu, and Pb. T.Mikado, T.Tomimasu, T.Yamazaki (High-Energy Radiation Section, Electrotech. Lab., Ibaraki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3003-9 (Sept. 1983).
Average energy losses (ϵ_{AV}) were evaluated from total energy spectra. The total energy spectra $F(E)$ are classified into two groups according to the composition procedure: (A) integrations of $f(E,\theta)$, representing energy spectra measured at various emission angles (θ) including backward angles, over θ, and (B) crude estimates based upon $f(E,0°)$ with reference to relations between $F(E)$ and $f(E,0°)$ for group A, where $f(E,0°)$ had been calculated by means of the Blunck-Leisegang-Westphal theory. The general trends of ϵ_{AV}/t_A vs. t_A, with t_A being the corrected path length of the electrons in a material, obtained from $F(E)$ for group B agree well with those for group A. The estimated values of ϵ_{AV}/t_A for C and Al are a little larger than those taken from the Berger-Seltzer table and those for Cu and Pb are a little smaller than the tabulated values. (21 refs.)

119076 Simulation of collision cascades in intermetallic V_2Hf compounds. V.G.Chudinov, V.P.Gogolin, B.N.Goshchitskii, V.I.Protasov (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K57-60 (Sept. 1983).
The molecular dynamics technique is used to simulate a collision cascade in V_2Hf. The calculations were carried out on a crystallite of almost spherical shape which consisted of 3800 atoms, 2000 of which being located on the immobile wall. This wall allowed one to keep atoms of the mobile part during the calculation at the sites of the C-15 structure. The energy was removed from $\approx$400 atoms of the intermediate layer. The kinetic energy of these atoms could be decreased by a definite value at every time step. The rate of removal was taken equal to 0.9 taking into account the absence of highly energetic atoms from the hard wall. (5 refs.)

119077 Ion dechanneling due to lattice strains in semiconductor superlattices. J.H.Barrett (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2328-34 (1 Sept. 1983).
A new source has been considered for the unusual ion dechanneling found in InAs-GaSb superlattices. This new source stems from the strains that occur in the layers because of the slight mismatch between the lattice constants of the two materials. The strains cause the rows and planes of atoms in the crystal that are inclined to the surface normal to have small directional misalignments at the interfaces between the layers. The effects of these misalignments have been incorporated into computer simulations of ion trajectories in the crystal and have been shown by means of the simulations to account in a reasonable manner for the observed dechanneling behaviour. Two ways of measuring the amount of misalignment are suggested as a result of the simulations. Calculations have also been done as a function of the amount of misalignment to give some indication of how much dechanneling might be expected for superlattices composed of other pairs of materials with different degrees of mismatch. (18 refs.)

119078 Determination of the parameters of diffraction channeling of electrons in single crystals from the backscattering energy spectra. V.P.Artem'ev, V.V.Makarov, N.N.Petrov, O.A.Podsvirov (M.I. Kalinin Polytech. Inst., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.390-4 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.684-91 (March 1983). [received: Oct. 1983]
A new method is proposed for the determination of the parameters of diffraction channeling of electrons in bulk single crystals. This method is based on an analysis of the orientational contrast of a series of plasmon loss peaks in the backscattering energy spectra. The method is applied to the experimental data obtained for amorphous and single-crystal silicon on which electrons of energies ~10 keV are incident. The results are interpreted using two- and three-wave approximations of the dynamic theory of diffraction. The absorption coefficients of Bloch waves, the extinction length for the 220 reflection, and the corresponding Fourier components of the crystal lattice potential are determined. It is shown directly that the electron channeling effect becomes weaker near the surface of a crystal, in agreement with the model of a single wave field. (14 refs.)

Muon flux measurement with silicon detectors in the CERN neutrino beams .... See Entry 117722

Crystal site location of dopants in semiconductors using a 100-keV electron probe .... See Entry 119036

Annealing of $Hg_{1-x}Cd_xTe$: Hg loss rates and annealing of ion implantation damage .... See Entry 119040

Damage production in GaAs by H^+ irradiation .... See Entry 119072

62.00 MECHANICAL AND ACOUSTIC PROPERTIES OF CONDENSED MATTER

(see also 46.30 Mechanics of solids and rheology, 61.70 Defects in crystals, 68.25 Surfaces and interfaces, 81. Materials science; for thermomechanical effects, see 65.70; for magnetomechanical effects, see 75.80; for piezoelectric effects, see 77.60; for elasto-optical effects, see 78.20H)

62.10 MECHANICAL PROPERTIES OF LIQUIDS

(for viscosity of liquids, see 66.20)

119079 Excess volumes of binary mixtures of cyclohexanone with some monosubstituted benzenes at 298.15K. B.Chawla, S.K.Mehta, R.V.Jasra, S.K.Suri (Dept. of Chem., Indian Inst. of Technol., New Delhi, India).
Can. J. Chem. (Canada), vol.61, no.9, p.2147-50 (Sept. 1983).
Molar excess volumes for the binary mixtures of cyclohexanone with benzene and some monosubstituted benzenes, namely, toluene, ethylbenzene, isopropylbenzene, tertiary butylbenzene, chlorobenzene, bromobenzene, iodiobenzene, *N,N*-dimethylaniline, nitrobenzene, benzaldehyde, and benzonitrile have been calculated from the precise and accurate experimental density data at 298.15K over the entire composition range. The results have been discussed in terms of the strength of molecular interactions in the binary mixtures. (15 refs.)

119080 Density of liquid $Hg_{1-x}Cd_xTe$. D.Chandra, L.R.Holland (Space Sci. Lab., NASA Marshall Space Flight Center, Huntsville, AL, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1620-4 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
Negative thermal expansion has been established in liquid $Hg_{1-x}Cd_xTe$ for $x<0.2$ employing a pycnometric method. Pure HgTe increases in density from its melting point at 670°C to a maximum value at ~750°C, where normal thermal expansion progressively resumes. The dependence of density on temperature for liquid $Hg_{1-x}Cd_xTe$ arises almost exclusively from the HgTe portion of the melt, while CdTe acts as a diluent. The temperature corresponding to the maximum density changes slightly with composition, increasing by about 5°C for $x=0.1$. (13 refs.)

119081 Molar volumes and fluidities of seed oils and their fatty acids. N.Islam, I.Ahmad (Dept. of Chem., Aligarh Muslim Univ., Aligarh, India).
Indian J. Chem. A, vol.22A, no.3, p.229-30 (March 1983). [received: Oct. 1983]
The densities and viscosities of the seed oils of Vernonia anthelmintica (A), Leucas caphalotes (B), and those of their component fatty acids, viz. palmitic, oleic, stearic and myristic acids, are measured over the temperature range 298-433K. These data are least-squares-fitted to equations of relevance. The Hildebrand equation seems to be better than that of Doolittle in explaining the data. The temperature dependence of the energies of activation is described by a parabolic equation. (8 refs.)

119082 Volumetric and dielectric properties of benzene solutions of some tri-n-alkylammonium halides at 298.15K. C.Klofutar, S.Paljk (J. Stefan Inst., E. Kardelj Univ. of Ljubljana, Ljubljana, Yugoslavia).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.10, p.2377-87 (Oct. 1983).
The densities of benzene solutions of tri-n-alkylammonium bromides and tri-n-alkylammonium iodides up to 0.100 mol. kg^{-1} and the electric permittivities at 2 MHz of benzene solutions of tri-n-alkylammonium chlorides, bromides and iodides up to $X_2=0.005$ (ca. 0.065 mol. kg^{-1}) in a homologous series from the tri-n-propylammonium to the tri-n-dodecylammonium salt have been measured at 298.15K. The molar polarizations of the solutions and the partial molar polarizations, partial molar volumes and dipole moments of the solutes have been calculated. From the dipole moments of the solutes at infinite dilution the interionic distances in the ion pairs, the total electrostatic interaction energies and the interaction energies due to the mutual polarizations of ions in ion pairs have been calculated; the results are discussed on the basis of self-aggregation processes of solute molecules. (30 refs.)

119083 Elastic deformations and electrohydrodynamic instabilities in large pitch cholesteric liquid crystals under an electric field. M.L.Sartirana, B.Valenti (Istituto di Chimica Industriale, Univ. di Genova, Genova, Italy), R.Bartolino.
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.321-47 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Reports experimental observations on large pitch cholesteric liquid crystals in the planar geometry submitted to DC or low frequency AC field applied along the helical axis. An electric field can cause orientation of the molecules in the field direction or disruption of the orientation due to the hydrodynamic effect of current carriers. The behavior of the samples depends upon the sign and the absolute value of the dielectric anisotropy ϵ_a. The authors have investigated a wide range of systems by using nematic matrices with ϵ_a between -4 and $+33$ doped with small amounts of cholesteryl chloride and cholesteryl benzoate. Instabilities are observed in negative ϵ_a mixtures; depending upon the frequency, two regimes can be found, as in nematics. The behavior about threshold depends largely on the magnitude of the negative anisotropy. In the case of a small positive ϵ_a, domain instabilities and elastic deformations occur. (40 refs.)

Excess free volume and intermolecular interaction for some binary molten metal halide mixtures .... See Entry 118830

Stokes-Maxwell relations for the distorted fluid microstructure .... See Entry 118840

Free volume and internal pressure of liquid mixtures from ultrasonic velocity of different temperatures .... See Entry 119103

Acoustical study of aqueous solutions of sodium sulphate and thiosulphate .... See Entry 119107

On the correspondences between experimental sound velocities in liquid N_2O_4 with density and specific heat .... See Entry 119109

Existence of a novel liquid phase in methyl acetate .... See Entry 119169

The nematic elastic constants from the Ginzberg-Landau Hamiltonian of the nematic to isotropic phase transition .... See Entry 119190

Transitions and relaxations in mesophase polymers: thermotropic liquid crystalline polyesters with mesogenic groups in the main chain .... See Entry 119194

Isothermal transport properties in solutions of symmetrical tetraalkylammonium bromides .... See Entry 119240

Studies in some physical properties of amino acids. I. Specific rotations, apparent molal volumes and adiabatic compressibilities of *l*-amino acids in mixed solvents .... See Entry 120017

Selective solvation of polystyrene in tetralin/cyclohexane mixtures .... See Entry 120620

Structural and mechanical properties of polydisperse suspensions of electrocorundum .... See Entry 120678

62.20 MECHANICAL PROPERTIES OF SOLIDS (RELATED TO MICROSCOPIC STRUCTURE)

(see also 81.40 Treatment of materials and its effects on microstructures and properties, 81.70 Materials testing)

119084 Dependence of the specific volume of the bisphenol-A polycarbonate on its molecular characteristics. Z.Dobkowski, D.Grzelak (Inst. Chem. Przemyslowej, Warszawa. Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.2, p.44-6 (Feb. 1983). In Polish. [received: Oct. 1983]
The dependence of the specific volume of the linear polydisperse bisphenol-A polycarbonate (PC) on its molecular weight and molecular weight distribution has been described. The Fox-Flory relationship, valid for polystyrene above its glass transition temperature, $v=A_0+A_1/M$, holds for amorphous PC at 23°C, i.e. below the glass transition temperature of PC. The following values of the constants for PC were calculated: $v_\infty=0.8338$ cm^3/g, $\rho_\infty=1.1993$ g/cm^3 and $A_1=27.15$ $cm^3/mole$. (10 refs.)

119085 Temperature dependence of the theoretical strength of simple cubic lattices. V.L.Gilyarov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.544-5 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.944-6 (March 1983). [received: Oct. 1983]
Problems of the temperature-dependent strength of solids (the upper limit of stability with respect to lattice dynamics as the basis for the thermal fluctuation treatment of fracture) have recently been much discussed. The author gives the results of calculating the theoretical strength of simple cubic lattices in the nearest neighbor approximation on the basis of the self-consistent method. (5 refs.)

62.20D Elastic constants

(see also 03.40D Mathematical theory of elasticity, 81.40J Elasticity and anelasticity)

119086 Third-order elastic coefficients of NaCl and KCl and invariance relations. P.Hegedus, S.Kolnik, C.Musil, I.Varga (Katedra Fyziky VSDS, Zilina, Czechoslovakia).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.5-6, p.283-91 (1983).
An experimental research of third order elastic coefficients of NaCl and KCl crystals at room temperature has been carried out. Ultrasonic velocities and their pressure changes were appreciated by using acoustic invariance relations for second and third order elastic coefficients. The obtained values of the third order elastic coefficients are compared with the values reported by other authors. (8 refs.)

119087 Ultrasonic investigations of incommensurate $(NH_4)_2BeF_4$. U.Straube, D.Grutzmann, G.Sorge (Sektion Phys., Martin-Luther-Univ. Halle-Wittenberg, Halle/Saale, Germany).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.5-6, p.315-19 (1983).
The elastic stiffness coefficient c_{66} of AFB in its incommensurate phase and near the paraelectric-incommensurate and incommensurate-ferroelectric phase transition was determined by ultrasonic measurements at 20 MHz. An anomaly in the temperature dependence of this coefficient and the corresponding attenuation coefficient near the lower phase transition could not be detected in contrast to the suggestions of Petzelt and the results on other substances with an incommensurate phase. (14 refs.)

119088 Polarization effects in a layer system with elastic anisotropy. I.Cap, S.Kolnik (Dept. of Phys., Tech. Univ. of Advanced Transport & Communication Engng., Zilina, Czechoslovakia).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.5-6, p.337-41 (1983).
Deals with a method of measuring the thickness of anisotropic layers. The interference of two acoustic pulses corresponding to two independent shear modes in an anisotropic medium is utilized. Direct electromagnetic generation and detection of acoustic waves in a metal medium in the presence of a constant magnetic field are used. The theoretical considerations are verified by an experiment. (2 refs.)

119089 Determination of nonlinear elastic coefficients by resonant methods. A.A.Demidenko, A.P.Zdebskii, V.N.Piskovoi, A.U.Savchuk (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K73-6 (Sept. 1983).
A resonant method of calculation and experimental investigations of third-order elastic coefficients are carried out for polycrystalline $BaTiO_3$ with additions of CeO_2 (temperature of ferroelectric phase transition $T_c=33°C$) in the paraelectric region where this material is non-piezoelectric. After applying a constant electric field E° to the specimen it may be regarded as a transverse-isotropic one with axis of symmetry (index 3) parallel to E°. (5 refs.)

119090 Elastic constants of citric acid monohydrate. Md.Shahabuddin Khan, T.S.Narasimhamurty (Univ. Coll. of Sci., Osmania Univ., Hyderabad, India), Y.V.Ramana.
Solid State Commun. (USA), vol.48, no.2, p.169-72 (Oct. 1983).
All the elastic constants of citric acid monohydrate (CA) single crystal of (D_2) class of orthorhombic system determined at room temperature are reported. These constants have been computed from compressional and shear wave velocity measurements along different directions of propagation in (CA) single crystals using two separate dynamic methods—the pulse transmission method and the thickness resonance method. The values of linear compressibilities, volume compressibility and Poisson's ratios for (CA) single crystal at room temperature have also been deduced. (10 refs.)

A study on GRP skin/foam core sandwich structures .... See Entry 118413

Note on shear interaction between two fibers .... See Entry 118415

Calculation of the elastic characteristics of a unidirectional fiber composite by the cross-section method .... See Entry 118419

On the transverse vibration of a rubber string .... See Entry 118476

The bonding properties of mercury-cadmium telluride .... See Entry 118948

Use of Harrison's potential in mixed alkali halide crystals ... See Entry 118955

X-ray diffraction study of californium metal to 16 GPa .... See Entry 118959

A theory of mechanical properties of amorphous solids .... See Entry 119096

Elastic properties of proustite .... See Entry 119098

Investigation of the amplitude-dependent internal friction during plastic deformation of sodium chloride single crystals .... See Entry 119101

Direct electromagnetic generation of ultrasound in potassium .... See Entry 119113

Unified study of the lattice-mechanical properties of copper halide crystals .... See Entry 119132

Theory of the structural phase transition in A15 compounds .... See Entry 119182

High-pressure X-ray diffraction studies on HgTe and HgS to 20 GPa .... See Entry 119184

Magnetic, elastic, and thermal properties of Rb_2NaHoF_6 ......See Entry 119188

Some Monte Carlo calculations for the Lennard-Jones solid .... See Entry 119229

Thermal conductivity of lead sulfide-based solid solutions ..... See Entry 119285

Changes in the remanent magnetisation, magnetoelastic coupling and Young's modulus during structural relaxation of an amorphous ribbon .... See Entry 119888

The magnetic and magnetoelastic properties of amorphous metallic ribbons .... See Entry 119891

Mechanical characterization of sheet molding compound composites .... See Entry 120367

The mechanical properties of cellular solids .... See Entry 120377

Tensile and flexural properties of fibers of an extended chain polymer .... See Entry 120390

The influence of branch length on the deformation and microstructure of polyethylene .... See Entry 120395

On the stress distribution in ceramo-metallic composite beams and the occurrence of transverse cracks in the ceramic overlay .... See Entry 120397

Fracture toughness of fibre reinforced composite materials ...See Entry 120417

Effect of low-cycle loading on the mechanical characteristics and structure of unidirectional organoplastic .... See Entry 120425

Deformation and fracture of polydiacetylene single crystal fibres .... See Entry 120431

Correlations of the dry crazing resistance of glassy polymers with other physical properties .... See Entry 120460

Effects of water on glass-filled methacrylate resins .... See Entry 120468

Mechanical properties of the crazes in glassy polymers .... See Entry 120482

62.20F Deformation and plasticity

(inc. yield, ductility and superplasticity; see also 81.40L Deformation, plasticity and creep)

119091 Deformation of α-β brass with oriented and equiaxed duplex boundaries. C.F.Nilsen, K.N.Subramanian (Dept. of Metallurgy, Mech. & Materials Sci., Michigan State Univ., East Lansing, MI, USA).
Phys. Status Solidi a (Germany), vol.79, no.1, p.281-92 (Sept. 1983).
As an extension of investigations dealing with two-phase bicrystals of α-β brass, tensile testing is carried out at various strain rates on α-β brass specimens with oriented duplex and equiaxed duplex boundary geometries. The equiaxed boundary is more effective in blocking the propagation of deformation from α to β phase. A strain-rate sensitivity is found in all specimens regardless of boundary geometry. At low-strain-rates, both boundaries are found to be ineffective barriers to the propagation of deformation. At high strain-rates both boundaries fully resisted the passage of deformation. In the α phase at low strain-rates coarse slip is observed, while at high strain-rates fine slip occurs. Optical and scanning electron microscopic techniques are used to study the microstructural features of deformation. (35 refs.)

Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers .... See Entry 116931

A study on GRP skin/foam core sandwich structures .... See Entry 118413

The investigation of the behaviour of an elastic-plastic thick-walled tube under irradiation .... See Entry 118439

Compression failure of a unidirectional fibrous composite with an elastoplastic matrix .... See Entry 118441

Statistical theory of fibrous media. I. Longitudinal shear ......See Entry 118442

Characteristics of brittle fracture under general combined modes including those under bi-axial tensile loads .... See Entry 118497

A medium-resolution double-crystal diffractometer for the study of small-angle neutron scattering .... See Entry 118821

Temperature effect on domain structurization in segmented polyurethanes .... See Entry 118922

The bonding properties of mercury-cadmium telluride .... See Entry 118948

Dynamical electron diffraction from elastically bent organic crystals .... See Entry 118991

On a point defect inside an idealized elastic sphere .... See Entry 119010

Effects of nitrogen on dislocation behavior and mechanical strength in silicon crystals .... See Entry 119018

The effect of annealing on the defect structure and electrical properties of deformed single crystals of Ge .... See Entry 119019

Dislocation mobility in hydrostatically compressed KBr crystals .... See Entry 119021

Transport of electric charge by complete and partial dislocations in ZnS .... See Entry 119022

Strengthening of GaAs by impurity atom-vacancy complexes .... See Entry 119054

Beryllium fracture observed by in situ high voltage electron microscopy .... See Entry 119094

Change in effective cross section of cracks in the process of deformation of ice .... See Entry 119095

Investigation of the amplitude-dependent internal friction during plastic deformation of sodium chloride single crystals .... See Entry 119101

Anisotropic elastic limits and phase transitions of rutile phase TiO_2 under shock compression .... See Entry 119102

Temperature dependence of the wave vector of the incommensurate modulation in two $BaMnF_4$ crystals grown by different techniques; neutron and X-ray measurements .... See Entry 119176

Thermal expansion and isothermal compressibility of thallium telluride .... See Entry 119238

Influence of substrate deformations on interface structures. II. Experimental investigations for epitaxial Ag/Pd and Au/Pd bicrystals ....See Entry 119355

Role of grain boundaries in the trapping of a magnetic flux and in the change of plasticity during a superconducting-normal transition ....See Entry 119796

Influence of the torsional elastic strain on the magnetic behaviour in pure polycrystalline nickel .... See Entry 119887

Defect recovery and trapping in plastically deformed Au studied by perturbed angular correlations of ^{111}In .... See Entry 119964

Dependence of photoluminescence on temperature in dislocated silicon crystals .... See Entry 120142

Development of a new hybrid material (ARALL) for aircraft structure .... See Entry 120279

Cold pressing of wurtzite boron nitride powders under high pressures .... See Entry 120290

Development of high performance short fibre reinforced thermoplastics .... See Entry 120306

Residual stresses in plastics sheet and injection mouldings .... See Entry 120325

Long-term ageing characteristics of Hastelloy alloy X .... See Entry 120341

Can inherited textures in the BCC phase furnish information about the type of transformation from the FCC phase? .... See Entry 120350

The influence of thermal history on the microstructure of sulfonated polystyrene ionomers ....See Entry 120354

A TEM study of microstructural changes during retrogression and reaging in 7075 aluminum ....See Entry 120355

The properties of equimolar copolycarbonates of bisphenol A with bisphenol S and 1,4-bis(hydroxymethyl)cyclohexane ....See Entry 120357

Electron microscopy observation and X-ray microanalysis of aged martensites in a Cu-12.9 mass% Al-2.5 mass% Mn shape memory alloy ....See Entry 120359

Anelasticity and viscoplasticity in metallic glasses ....See Entry 120362

Matrix dominated properties of high performance composites ....See Entry 120364

Mechanical characterization of sheet molding compound composites ....See Entry 120367

Variability in static strengths of sheet molding compounds (SMC) ....See Entry 120368

Viscoelastic and plastic relaxation of residual stresses around macroparticle reinforcements in metal matrices ....See Entry 120369

Diffraction-contrast study of microstructure and deformation process of WC-Co cemented carbide ....See Entry 120370

Influence of the plastic deformation conditions under pressure on the structure and properties of Mo ....See Entry 120371

A high performance wrought nickel-base superalloy EI-929 ..See Entry 120372

High temperature compressive behaviour of as-cast Al-Cu alloys of varying composition ....See Entry 120374

The mechanical properties of PVC under high pressure ....See Entry 120375

The mechanical properties of cellular solids ....See Entry 120377

Influence of nonsteady state behavior on superplastic deformation of a 25.7 Cr-6.6 Ni stainless steel ....See Entry 120378

Microstructure and mechanical properties of Zn-Al alloys at room temperature ....See Entry 120379

Experimental investigation of the stability of fiberglass cylindrical shells subject to prolonged application of twisting moments ....See Entry 120380

The effect of physical ageing on the properties of poly(ethylene terephthalate) ....See Entry 120381

Polyurethane microcellular elastomers. I. Effect of chemical composition on tensile strength and elongation at break of poly(ethylene-butylene adipate) based systems ....See Entry 120382

Deformation and fracture behaviour of a rubber-toughened epoxy. I. Microstructure and fracture studies ....See Entry 120383

Deformation and fracture behaviour of a rubber-toughened epoxy. II. Failure criteria ....See Entry 120384

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Resistance to deformation of pressed strips from granulated alloys ....See Entry 120386

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Some microlocal effects of mechanical loading on the crystalline lamellae in bulk high density polyethylene ....See Entry 120391

High-temperature thermoviscoelasticity of drawn poly(ethylene terephthalate) ....See Entry 120392

SANS investigation of molecular conformation in shear bands, as related to yield mechanisms in glassy polymers ....See Entry 120393

Self consistent field calculations of internal conformational states in glassy polymers ....See Entry 120394

Internal stress and distortion in injection mouldings ....See Entry 120396

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Study of the relationship between fracture toughness (J_{IC}) and bulge ductility ....See Entry 120403

Study of the effect of heat treatment on low cycle fatigue in AISI 4340 steel by acoustic emission ....See Entry 120416

Fracture toughness and fatigue behavior of Matrix II and M-2 high speed steels ....See Entry 120420

Interlayer-strength criterion for carbon-fiber-reinforced plastics under cyclic loadings ....See Entry 120424

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Effect of dimensional factors of a disperse filler on the strength of epoxy composites ....See Entry 120426

Deformation and fracture of thermoplastics containing spherical particles: a comparison between rigid spheres and rubber particles ....See Entry 120444

Effect of length and diameter of wire on the interfacial shear stresses in wire embedded concrete specimens due to pull-out of wire ....See Entry 120448

High-temperature friction of alloys of the TiN_x-TiB_2 system ....See Entry 120449

Correlations of the dry crazing resistance of glassy polymers with other physical properties ....See Entry 120460

Craze growth kinetics and the mechanical behavior of thin polystyrene films ....See Entry 120481

Mechanical properties of molybdenum coated with titanium carbide film ....See Entry 120506

Weibull's distribution of time to stress corrosion cracking of Cu-Zn alloys ....See Entry 120515

Shock polymorphism of manganese fluoride ....See Entry 121218

62.20H Creep

(see also 81.40L Deformation, plasticity and creep)

119092 On the applicability of a phenomenological relationship to creep at low stresses and intermediate temperatures. T.Sritharan, H.Jones (Dept. of Metall., Univ. of Sheffield, Sheffield, England).
Mater. Sci. & Eng. (Switzerland), vol.61, no.1, p.1-5 (Oct. 1983).
In a recent paper (see ibid., vol.56, p.167, 1982) Ruano and Sherby used a phenomenological relationship of the form $\dot{\epsilon}\propto\sigma^2$ derived from superplasticity data to reinterpret some data for creep at low stresses. These data had been represented previously in the form $\dot{\epsilon}\sigma$-σ_0 with σ_0 as the threshold stress for the operation of vacancy diffusion creep. The present authors show that $\dot{\epsilon}\propto\sigma^2$ in fact gives a poorer representation of these creep data than does $\dot{\epsilon}\propto\sigma$-$\sigma_0$. This conclusion is based on (i) the marked curvature of plots of $\dot{\epsilon}^{1/2}$ versus σ consistent with $\epsilon\propto\sigma$-σ_0, (ii) the unit slope of log $\dot{\epsilon}$ versus log(σ-σ_0) plots and (iii) the creep rates observed which are two to three orders of magnitude larger than those predicted by the phenomenological relationship when used with the empirical diffusion coefficient D with which it was originally established. Use of this original D also virtually eliminates from their deformation map the field of dominance over Coble creep of the mode of deformation represented by $\dot{\epsilon}\propto\sigma^2$. Analysis finally shows that, when interpreted as $\dot{\epsilon}\propto\sigma$-$\sigma_0$, the phenomenological relation should give an apparent σ_0 which is independent of grain size, contrary to what is observed. (26 refs.)

Use of nonlinear models of viscoelasticity in the investigation of the effect of hydrostatic pressure on the shear creep of polymeric materials ....See Entry 118440

Brittle fracture under creep ....See Entry 118518

Predicting the creep of unidirectional reinforced plastic with thermorheologically simple structural components ....See Entry 118539

Bending of an infinitely long rectangular wire in conditions of radiation-induced creep and swelling ....See Entry 119056

Thermostimulated creep study of undoped polyacetylene $(CH)_x$ films ....See Entry 119099

Mechanisms of densification during the hot pressing of calcium oxide and synthetic doloma ....See Entry 120286

Anelasticity and viscoplasticity in metallic glasses ....See Entry 120362

Creep of Kevlar 49 fibre and a Kevlar 49-cement composite .See Entry 120373

Characterization of creep cavitation in sintered alumina by small-angle neutron scattering ....See Entry 120376

The mechanical properties of cellular solids ....See Entry 120377

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Deformation and fracture of thermoplastics containing spherical particles: a comparison between rigid spheres and rubber particles ....See Entry 120444

Dynamic mechanical spectroscopy of sheet molding compound as a function of offset stress ....See Entry 120517

Acoustic emission during short-term creep of fiberglass plastics ....See Entry 120554

62.20M Fatigue, brittleness, fracture, and cracks

(inc. hardness; see also 81.40N Fatigue, embrittlement and fracture)

119093 A fracture mechanics study of the fatigue of rubber in compression. A.Stevenson (Malaysian Rubber Producers' Res. Assoc., Hertford, England).
Int. J. Fract. (Netherlands), vol.23, no.1, p.47-59 (Sept. 1983).
Repeated deformation of rubber cylinders in compression causes cracks to initiate at tensile stress concentrations (e.g. bond edges). The cracks grow to remove the rubber which at maximum deformation bulges outside the original profile of the cylinder. The results are analysed in terms of fracture mechanics. The tearing energy, T, is substantially independent of crack length. The relation between crack growth rate dc/dN and T appears to be a material property, independent of testpiece geometry. (9 refs.)

119094 Beryllium fracture observed by in situ high voltage electron microscopy. T.C.Pollock (Engng. Design Graphics Dept., Texas A&M Univ., College Station, TX, USA), H.G.F.Wilsdorf.
Mater. Sci. & Eng. (Switzerland), vol.61, no.1, p.7-15 (Oct. 1983).
Beryllium single crystals were stained to fracture in a high voltage electron microscope and were studied using in situ and analytical techniques. The crystals were oriented so that the stress axis was parallel to the basal planes, thereby activating the prism planes of the first order during plastic deformation. Resulting dislocation cells were characterized and slip traces on external and fracture surfaces were analyzed. Microcracks were seen to initiate at dislocation cell walls and mostly continued to propagate along them. A pseudocleavage mechanism for microcracks has been discussed. (17 refs.)

119095 Change in effective cross section of cracks in the process of deformation of ice. V.P.Epifanov, M.A.Faustov.
Mech. Solids (USA), vol.17, no.6, p.156-62 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.171-6 (1982). [received: Oct. 1983]
In this study, by means of an experimental investigation of the deformation characteristics and the parameters of probe pulses and acoustic emission signals, the authors determined the dimensions, orientation, and law of accumulation of cracks forming under uniaxial compression of specimens. The relationship between the acoustic variables and the formation and accumulation of cracks is established in model experiments involving cracks that were artificially introduced into the specimens (either mechanically or by means of a laser signal). (12 refs.)

119096 A theory of mechanical properties of amorphous solids. I.A.Akhiezer.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1399-402 (Sept. 1983). In Russian.
Amorphization is analyzed as affecting breaking mechanical stresses, elastic moduli and densities of solids. It is shown that with equal short-range orders the nominal breaking stress and Young's modulus are amorphization-independent and controlled only by the specimen density. When there are no extended defects in amorphous solids, the breaking stresses for them are controlled by nominal hardness and can significantly exceed the breaking stresses for crystalline modifications of the same material. (7 refs.)

Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers ....See Entry 116931

Characteristics of brittle fracture under general combined modes including those under bi-axial tensile loads ....See Entry 118497

Distribution function of dislocations and condition of finite stress for the dislocation-free zone model of fracture .... See Entry 118511

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Dynamic bulk and shear relaxations in solid polymers: relationship to deformation behavior .... See Entry 120365

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Failure mechanism discrimination in carbon fibre-reinforced epoxy composites .... See Entry 120399

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Impact behaviour of tungsten carbide-cobalt alloys .... See Entry 120401

On a search for epsilon crack tip plastic zones in the fatigue of amorphous polymers .... See Entry 120402

Study of the relationship between fracture toughness (J_{IC}) and bulge ductility .... See Entry 120403

Molecular dynamics simulation of crack tip processes in alpha-iron and copper .... See Entry 120404

Statistical analysis of multiple fracture in 0°/90°/0° glass fibre/epoxy resin laminates .... See Entry 120405

Compression fracture statistics of compacted cement cylinders .... See Entry 120406

Macroscopic fracture surface energy of unidirectional metal matrix composites: experiment and theory .... See Entry 120407

A new statistical model of the hydrogen embrittlement of steel .... See Entry 120408

Statistical study of thermal shock damage of a borosilicate glass .... See Entry 120409

Measurement of dynamic hardness by controlled sharp-projectile impact .... See Entry 120410

Mechanical properties of fine-grained substoichiometric titanium carbide .... See Entry 120411

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Quantitative correlation of acoustic emission to the brittle fracture of porous sintered glass .... See Entry 120413

Hydrogen embrittlement of three metallic glasses .... See Entry 120414

Effects of metallurgical variables on hydrogen embrittlement in AISI type 316, 321 and 347 stainless steels .... See Entry 120415

Study of the effect of heat treatment on low cycle fatigue in AISI 4340 steel by acoustic emission .... See Entry 120416

Fracture toughness of fibre reinforced composite materials ... See Entry 120417

Relationships between fatigue resistance and spheroidization of graphite in nodular cast iron .... See Entry 120418

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Fracture toughness and fatigue behavior of Matrix II and M-2 high speed steels .... See Entry 120420

The effects of heat treatment on fracture toughness and fatigue crack growth rates in 440C and BG42 steels .... See Entry 120421

Fractographic observations of cleavage initiation in the ductile-brittle transition region of a reactor-pressure-vessel steel .... See Entry 120422

A study on statistical fatigue properties of metallic materials with particular attention to the relation between fatigue life and fatigue strength distributions .... See Entry 120423

Interlayer-strength criterion for carbon-fiber-reinforced plastics under cyclic loadings .... See Entry 120424

Effect of low-cycle loading on the mechanical characteristics and structure of unidirectional organoplastic .... See Entry 120425

Effect of dimensional factors of a disperse filler on the strength of epoxy composites .... See Entry 120426

Quasi-brittle fracture of specimens with a cutout in the form of a line .... See Entry 120427

Fatigue strength of Elit 25, a glass-fibre reinforced poly(ethylene terephthalate) .... See Entry 120428

Fatigue strength of Itamid 25 (glass-fibre reinforced polyamide-6) .... See Entry 120429

Development of a crack growth algorithm for time-dependent analysis of steam turbine rotors .... See Entry 120430

Deformation and fracture of polydiacetylene single crystal fibres .... See Entry 120431

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Molecular aspects of crack formation and healing in glassy polymers .... See Entry 120433

Unified approach to crack growth in glassy polymers under any load conditions .... See Entry 120434

Ductile fracture of polypropylene .... See Entry 120435

On the strength of vulcanized rubbers .... See Entry 120436

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Direct measurements of craze zones at crack tips in glassy thermoplastics during fatigue crack growth .... See Entry 120438

Fatigue crack propagation in amorphous polymers .... See Entry 120439

Fatigue of rubber in compression .... See Entry 120440

Micromechanical failure predictions for polymer-matrix composites .... See Entry 120441

The use of fracture maps in a failure analysis of fibre composite materials .... See Entry 120442

Microstructure and fracture mechanical properties of short fiber reinforced thermoplastic PET .... See Entry 120443

Deformation and fracture of thermoplastics containing spherical particles: a comparison between rigid spheres and rubber particles .... See Entry 120444

Crack propagation in a rubber-toughened epoxy .... See Entry 120445

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Effects of water on glass-filled methacrylate resins .... See Entry 120468

The disentanglement time of the craze fibrils in polymethylmethacrylate .... See Entry 120469

Methanol crazing of coarse shear bands in polystyrene .... See Entry 120470

A fracture mechanics approach to surface embrittlement in ductile polymers .... See Entry 120478

Crack initiation in thermooxidized surface skins of polyethylene .... See Entry 120479

Craze microstructure and micromechanics: the effects of entanglements .... See Entry 120480

Toughness in PB/PS block copolymers and blends .... See Entry 120484

Mechanical behaviour of TiC film coated on molybdenum by magnetron sputtering .... See Entry 120507

Dynamic fracture toughness of structural steels by instrumented charpy test .... See Entry 120578

62.20P Tribology

(see also 81.40P Friction, lubrication and wear)

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Friction and wear in ultra high vacuum a contribution to tribology .... See Entry 120450

The role of wear debris in the study of wear .... See Entry 120451

Wear studies through particle size distribution. I Application of the Weibull distribution to ferrography .... See Entry 120452

The contribution of particle analysis to the study of wear of metals .... See Entry 120453

Laboratory evaluation of the on-line Ferrograph .... See Entry 120580

Continuous wear measurement by on-line ferrography .... See Entry 120581

The deleterious effect arising from preparation of ferrograms in ferrography and the consequences in subsequent analysis of wear particulates .... See Entry 120582

Wear studies through particle size distribution. II. Multiple field analysis in ferrography .... See Entry 120583

62.30 MECHANICAL AND ELASTIC WAVES

(see also 03.40K Mathematical aspects)

119097 Temperature dependence of the attenuation and the velocity of longitudinal elastic waves in polymers and acoustic estimation of their strength at 4.2K. V.I.Utchastkin (Dept. of Phys., Moscow Inst. of Advance Transport Engng., Moscow, USSR).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.5-6, p.365-8 (1983).
The temperature investigation of the attenuation and the velocity of longitudinal elastic waves in some solid polymers are reported. Polymer classification of three groups is explained on the basis of one-dimensional crystal grating model calculation of the elastic wave velocity. The data of the elastic wave velocity and strength are compared at the temperature of 4.2K. The polymer strength estimation method using acoustic parameters is shown. (5 refs.)

119098 Elastic properties of proustite. Yu.F.Gorin, L.Ya.Kobelev, A.N.Babushkin, Yu.S.Kuznetsov (A.M. Gorki Ural State Univ., Sverdlovsk, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.531-2 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR),* vol.25, no.3, p.922-4 (March 1983). [received: Oct. 1983]
The authors have investigated the temperature dependences of the velocities of propagation of elastic waves in the well-known ferroelectric semiconductor proustite Ag_3AsS_3. Longitudinal and transverse elastic waves traveled along the C_3 axis of the crystal lattice. Measurements were made by the pulse-phase method at frequencies of about 5 MHz, which made it possible to determine the relative changes in the velocity of an ultrasonic wave with an accuracy of at least 0.02%. The absolute values of the velocities measured at 300K were 2.7×10^3 and 1.2×10^3 m/sec for the longitudinal v_L and transverse v_T ultrasonic waves, respectively. (9 refs.)

Surface Love waves in orthotropic regularly layered composites .... See Entry 118478

Scattering of elastic waves from simple defects in solids, a review .... See Entry 119008

Elastic constants of citric acid monohydrate .... See Entry 119090

Phonons, phonon focusing, and helicon-phonon interaction .... See Entry 119119

62.40 ANELASTICITY, INTERNAL FRICTION, AND DAMPING

(see also 81.40J Elasticity and anelasticity)

119099 Thermostimulated creep study of undoped polyacetylene $(CH)_x$ films. T.Elsayed, J.Elhout (Lab. de Phys. des Solides, Univ. Paul Sabatier, Toulouse, France), B.Francois, C.Mathis, D.Chatain, C.Lacabanne.
J. Phys. Colloq. (France), vol.44, no.C-3, p.131-4 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The anelastic properties of undoped polyacetylene films have been followed during isomerization and thermal treatment between 77 and 433K by the thermostimulated creep TSC technique. The TSC spectra of the trans isomer show three retardation modes: between 110-160K, between 270-330K and over 400K. The two modes at lower temperature have two components. Each one has been experimentally resolved into elementary processes characterized by retardation times following a compensation law. (10 refs.)

119100 High-temperature internal friction peaks of pure aluminium. K.Iwasaki (Inst. of Phys. & Chem. Res., Saitama, Japan).
Phys. Status Solidi a (Germany), vol.79, no.1, p.115-24 (Sept. 1983).
The effects of deformation and successive annealings on the high temperature internal friction peak (so-called grain boundary peak) of pure aluminum are investigated. The peak is divided into two components, a low and a high temperature component, with the use of differentiated vibration period. The former and the latter components are considered to be related with lattice dislocations and grain boundary dislocations, respectively. (24 refs.)

119101 Investigation of the amplitude-dependent internal friction during plastic deformation of sodium chloride single crystals. A.B.Lebedev, S.B.Kustov, B.K.Kardashev (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.511-12 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR),* vol.25, no.3, p.890-2 (March 1983). [received: Oct. 1983]
The authors deal with changes in the amplitude dependences of the internal friction in a crystal being deformed. They have measured the internal friction using apparatus controlled automatically with an Elektronika D3-28 microcomputer. The response of the automated apparatus enabled them to determine one amplitude dependence with a sufficient number of experimental points (~100) in about 20 sec. Static deformation took place in an Instron (model 1341) machine and it involved three-point bending. (7 refs.)

The influence of external and internal friction on the dissipative vibrations of straight bars .... See Entry 118486

Stress redistribution in a ruptured fiber of a viscoelastic composite .... See Entry 118516

The photodamping of dislocations in KC1 single crystals .... See Entry 119023

Orientation and relaxation in uniaxially stretched atactic polystyrene .... See Entry 120020

Anelasticity and viscoplasticity in metallic glasses .... See Entry 120362

Analysis of mechanical relaxation processes in materials based on heat-resistant polymers .... See Entry 120363

Dynamic bulk and shear relaxations in solid polymers: relationship to deformation behavior .... See Entry 120365

Thermodynamic aspects of mechanical behavior of glassy polymers .... See Entry 120366

Viscoelastic and plastic relaxation of residual stresses around macroparticle reinforcements in metal matrices .... See Entry 120369

Theory of pseudo cross-link. III. Rheological behavior .... See Entry 120385

62.50 HIGH-PRESSURE AND SHOCK-WAVE EFFECTS IN SOLIDS

119102 Anisotropic elastic limits and phase transitions of rutile phase TiO_2 under shock compression. T.Mashimo, K.Nagayama (Faculty of Engng., Kumamoto Univ., Kumamoto, Japan), A.Sawaoka.
J. Appl. Phys. (USA), vol.54, no.9, p.5043-8 (Sept. 1983).
Anisotropic elastic limits and phase transitions of the rutile phase TiO_2 under shock compression are studied, on the basis of the measurements of particle-velocity histories and free-surface motions along the [100], [110] and [001] axis directions in the stress range up to 38.6 GPa. The stresses of the Hugoniot elastic limit (HEL) along the [100] and [001] axis directions are determined to be 7.8 ± 0.5 and 4.1 ± 0.3 GPa, respectively. These different HEL stresses are reasonably analyzed by an inherent yield stress of 3.0 ± 0.3 GPa. A Hugoniot kink at 12.2 ± 0.6 or 17.0 ± 0.7 GPa along the [100] or [110] axis direction, respectively, and two kinks at 10.6 ± 0.5 and 33.7 ± 1.3 GPa along the [001] axis direction are observed. Considering the volume changes and the recovery experiments of the α-PbO_2 phase, two former ones and the last one are suggested to correspond to the beginning of phase transitions to a α-PbO_2 phase and a hexagonal phase, respectively. These anisotropic behaviors clearly show the typical evidences of the uniaxial strain effects of shock wave metamorphism of crystals. (17 refs.)

On interaction of thermo-acoustic waves with the progress of phase transition: a continuum approach. II. Growth and decay of thermo-acoustic waves .... See Entry 118484

X-ray diffraction study of californium metal to 16 GPa .... See Entry 118959

Determination of changes in the sound velocity in shock loaded Ti-6Al-4V with in-material manganin gauges .... See Entry 119112

Polymorphic transformations of rare-earth oxides under shock stress .... See Entry 119171

Landau theory of pressure induced phase transitions in TTF-TCNQ .... See Entry 119178

Pressure-induced phase transition in β-$LiIO_3$ .... See Entry 119183

Electronic structure of transition metals under pressure .... See Entry 119424

Structural properties of III-V zinc-blende semiconductors under pressure .... See Entry 119494

High pressure effects in MEM-$(TCNQ)_2$ .... See Entry 119575

Pressure effects in $HfTe_5$ and $ZrTe_5$ .... See Entry 119612

Mossbauer-effect study of the Morin transition and atomic positions in hematite under pressure .... See Entry 119842

Luminescence of high pressure phases of Eu^{2+}-activated alkaline earth borates and silicates .... See Entry 120135

The mechanical properties of PVC under high pressure .... See Entry 120375

Shock polymorphism of manganese fluoride .... See Entry 121218

62.60 ACOUSTIC PROPERTIES OF LIQUIDS

(see also 62.80 Ultrasonic relaxation; for sound propagation, see 43.; for second sound in quantum fluids, see 67.40, 67.50 and 67.60)

119103 Free volume and internal pressure of liquid mixtures from ultrasonic velocity of different temperatures. N.Prasad, S.Singh (G.B. Pant Univ. of Agriculture & Technol., Pantnagar, India).
Acoust. Lett. (GB), vol.6, no.12, p.182-4 (June 1983).
The free volumes and internal pressures of mixtures of triethylamine (TEA)+methanol, triethylamine+ethanol and triethylamine+n-propanol have been computed from ultrasonic velocity, density and viscosity data at 303.15K, 308.15K and 313.15K and the results have been plausibly explained in terms of molecular interactions. (11 refs.)

119104 Absorption of longitudinal ultrasonic waves in polymer solution (polymethyl methacrylate). M.A.Sidkey, A.M.Abd El-Fattah (Nat. Inst. of Standards, Cairo, Egypt).
Fizika (Yugoslavia), vol.15, no.3, p.239-45 (July-Sept. 1983).
Measurements of the change of absorption coefficient of longitudinal ultrasonic waves were carried out over the temperature range from 10°C to 50°C in a 2% solution of polymethyl methacrylate in benzene irradiated with intense ultrasonic waves. The ultrasonic absorption measurements were performed by the pulse technique at frequencies of 2.5, 4, and 6 MHz. A marked change in absorption coefficient was observed as the temperature, and intensity of ultrasonic waves increased. A qualitative discussion is given on the assumption that the structural changes induced by intense ultrasonic waves, as well as by the temperature are related to changes in the number of degraded groups in the polymeric network. (12 refs.)

119105 Ultrasonic study of critical behavior in the binary liquid 3-methylpentane+nitroethane. C.W.Garland, G.Sanchez (Dept. of Chem., MIT, Cambridge, MA, USA).
J. Chem. Phys. (USA), vol.79, no.6, p.3090-9 (15 Sept. 1983).
The acoustic velocity and attenuation have been measured in a critical mixture of 3-methylpentane+nitroethane over the frequency range 1-17 MHz and the temperature range $0.004\leq T-T_c\leq13.5$K. No critical dispersion was observed in the velocity, which varied linearly with T. A substantial critical attenuation was well characterized as a function of the reduced frequency $\omega^*\equiv\omega/\omega_D$ over the range $10^{-1}\leq\omega^*\leq10^6$. The experimental data in this system are extensive enough to permit quantitative tests of the predictions of dynamic scaling theory, dynamic renormalization-group theory, and several versions of mode-coupling theory. Universality in the scaling function for the critical attenuation is demonstrated by comparison with comparable experimental in two pure fluids. (41 refs.)

119106 Critical ultrasonic attenuation in the binary liquid cyclohexane+-nitroethane. G.Sanchez, C.W.Garland (Dept. of Chem., MIT, Cambridge, MA, USA).
J. Chem. Phys. (USA), vol.79, no.6, p.3100-3 (15 Sept. 1983).
The ultrasonic velocity and attenuation have been measured in the critical binary mixture cyclohexane+nitroethane over the frequency range 3-27 MHz and the temperature range $0.01\leq T-T_c\leq15$ K. The sound velocity varies linearly with T and shows no critical dispersion in this frequency range. The critical attenuation is analyzed in terms of the dynamic scaling theory of Bhattacharjee and Ferrell. In general, the agreement between theory and experiment is good but the data conform to an empirical scaling function that differs in small but systematic ways from the theoretical scaling function. Universality in the critical acoustic behavior is demonstrated by a comparison of the scaled attenuation in three binary liquid systems with that in two pure fluids. (12 refs.)

119107 Acoustical study of aqueous solutions of sodium sulphate and thiosulphate. S.B.Grigor'ev, K.N.Marenina, I.G.Mikhailov, A.K.Partman, L.I.Savina.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.94-6 (Aug. 1983). In Russian.
Ultrasonic propagation in aqueous solutions of sodium sulphate and thiosulphate has been studied as a function of concentration and frequency. Adiabatic compressibilities are calculated from ultrasonic velocity data. Measurements of ultrasonic absorption have been carried out in the frequency range 4-930 MHz. In sodium thiosulphate solution single relaxation is found near 600 MHz. Sodium sulphate solution has two relaxation frequencies about 40 MHz and 600 MHz respectively. Rate constants and volume effects of association reactions are calculated. (10 refs.)

119108 Experimental determination of ultrasonic velocity in liquid N_2O_4 at temperatures of 282-417K and up to 80 MPa pressure. O.V.Belyaeva, V.A.Nikolaev, V.I.Struchkov, V.D.Timofeev.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.50-4 (1983). In Russian.
The experimental data on acoustic velocities in liquid nitrogen tetroxide in the temperature range 282-417K and pressure range 1-80 MPa have been obtained on an ultrasonic interferometer with 0.16% error. The results at the temperatures above 360K have been obtained for the first time. The

experimental data for the test range of state parameters are described in terms of an interpolation polynomial. (7 refs.)

119109 On the correspondences between experimental sound velocities in liquid N_2O_4 with density and specific heat. O.V.Belyaeva.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.65-8 (1983). In Russian.
On the basis of analysis of the interpolating equation of state for liquid nitrogen tetroxide obtained by joint treatment of data on density, sound velocity and isobaric heat capacity, conclusions have been drawn about consistency of these values in the range of experimental study within the limits of experimental error. A table of calculated values of isochoric heat capacity is given. (10 refs.)

Packing and conformational contributions in binary liquid mixtures: acoustic studies of n-hexadecane with dimethylpentanes ....See Entry 118851

Metal carbonyl bond strengths: applications of photoacoustic calorimetry ....See Entry 120651

62.65 ACOUSTIC PROPERTIES OF SOLIDS

(see also 62.80 Ultrasonic relaxation; for sound propagation, see 43.; for lattice dynamics and phonons, see 63.; for magnetoacoustic effects, see 72.55; for acoustoelectric effects, see 72.50; for acousto-optical effects, see 78.20H)

119110 Surface acoustic wave measurements by phase sensitive optical detection. K.Capova (Dept. of Theoretical Electrotech. & Electrical Engng., Tech. Univ. of Advanced Transport & Communication Engng., Zilina, Czechoslovakia).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.5-6, p.359-63 (1983).
The incident laser beam is focused on a small diffraction limited spot on the surface acoustic wave propagating surface where it is reflected. The reflected light contains information about local properties of the SAW at the point of the light reflection. A phase sensitive detection of the laser beam is used to get information about the SAW from the reflected light. (2 refs.)

119111 Stress dependence of magnetically induced ultrasonic shear wave velocity change in polycrystalline A-36 steel. H.Kwun, C.M.Teller (Instrumentation Res. Div., Southwest Res. Inst., San Antonio, TX, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.4856-63 (Sept. 1983).
Magnetically induced changes in the velocity of 4.5-MHz ultrasonic shear waves were investigated in polycrystalline A-36 steel as a function of both uniaxial tensile and compressive stresses. The velocity changes induced by the applied magnetic field exhibit distinctly different stress effects depending on the relative orientations between the shear wave polarization, the magnetic field, and the external stress axis as well as on the magnitude and sign, i.e. tensile or compressive, of the stress. The magnetically induced velocity changes and their stress dependence were found to be insensitive to the elastic anisotropy associated with the preferred orientation (rolling texture). Based on the magnetoelastic coupling in the material, a phenomenological account for the distinctly different stress effects on the magnetically induced velocity changes is given. Good semiquantitative agreement was found between the observed characteristic stress dependence of the magnetically induced velocity changes and the phenomenological explanation presented. The characteristic stress dependence of the magnetically induced velocity change together with its lack of sensitivity to the elastic anisotropy of the material offers a new means of nondestructively determining the magnitude, the direction, as well as the sign of an unknown stress in ferromagnetic materials. (29 refs.)

119112 Determination of changes in the sound velocity in shock loaded Ti-6Al-4V with in-material manganin gauges. Z.Rosenberg, Y.Meybar (ADA, Haifa, Israel).
J. Phys. D (GB), vol.16, no.10, p.L193-4 (14 Oct. 1983).
The authors present measurements of the variation of the longitudinal sound velocity with pressure in shock loaded Ti-6Al-4V specimens. The experimental technique is based on monitoring the stress-time history inside the target with thin manganin stress transducers. The resulting values can be represented by the following linear relation between the sound velocity C_L (mm μs^{-1}) and shock stress σ (kbar): $C_L = 6.13 + 0.0049\ \sigma$. This relation is in good agreement with published hydrostatic data for alpha titanium in the 0-9 kbar range. (5 refs.)

119113 Direct electromagnetic generation of ultrasound in potassium. G.V.Puskorius, J.Trivisonno (Phys. Dept., John Carroll Univ., Cleveland, OH, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3566-8 (15 Sept. 1983).
The direct electromagnetic generation of ultrasound has been studied in high-purity, single-crystal potassium. Electromagnetic acoustic transducers were used for both the generation and the detection of ultrasound, and a coherent phase-sensitive detection technique was used to measure the generated signals. The slow shear mode corresponding to the elastic constant C' was studied. The observed zero-field generation amplitude is three times greater than that predicted by the free-electron model which assumes specular scattering of electrons at the metal surface. A nonmonotonic variation of the generation amplitude for magnetic fields below the absorption edge has also been observed. The experimental results are compared with previous measurements and with a recent extension of the free-electron theory which assumes diffuse scattering of electrons at the metal surface. (11 refs.)

119114 On interaction of thermo-acoustic waves with the process of phase transition: a continuous approach. I. Constitutive equations and propagation velocities. K.Tanaka (Univ. of Osaka Prefecture, Osaka, Japan), Y.Tanigawa.
Rev Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.3, p.277-88 (May-June 1983). [received: Sept. 1983]
The thermomechanical behavior of thermoplastic materials in the process of solid-solid waves travelling in the material is the special concern of the authors. The constitutive equations for the stress and the entropy density are derived in rate-form, and the propagation condition of the thermo-acoustic waves is obtained. The interaction of the propagation velocity of waves with the progress of phase transition is studied. (20 refs.)

119115 The 'tilt' effect in the absorption of ultra-sound by metals in a low magnetic field. A.V.Golik, E.A.Zarudnyi, A.P.Korokyuk, V.L.Falko, V.I.Khizhyni (Inst. of Radiophys. & Electronics, Acad. of Sci., Kharkov, Ukrainian SSR).
Solid State Commun. (USA), vol.48, no.4, p.373-5 (Oct. 1983).
The 'tilt' effect in the electron-phonon interaction has been discovered experimentally in metals placed in a low magnetic field, such that the cyclotron radius of conduction electrons is larger than the sound wavelength. (5 refs.)

119116 Nonlinear optoacoustic interaction in photoconducting piezoelectrics. P.A.Pyatakov.
Sov. Phys.-Solid State (USA), vol.25, no.3, p.384-6 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.675-7 (March 1983). [received: Oct. 1983]
A study is made of the excitation of an acoustic wave in a piezoelectric semiconductor due to the interaction of two optical waves of the same frequency forming an interference grating of carriers in a photoconductor and due to the interaction of two acoustic waves which are coupled mutually and to the carrier grating by the density nonlinearity mechanism. Estimates indicate that the amplitude of the excited acoustic wave can be quite large for moderate intensities of the incident wave. (9 refs.)

On interaction of thermo-acoustic waves with the progress of phase transition: a continuum approach. II. Growth and decay of thermo-acoustic waves ....See Entry 118484

Scattering of elastic waves from simple defects in solids, a review ....See Entry 119008

Polarization effects in a layer system with elastic anisotropy ....See Entry 119088

Elastic properties of proustite ....See Entry 119098

Magnetic, elastic, and thermal properties of Rb_2NaHoF_6 ......See Entry 119188

Study of ferroelectric CsH_2PO_4 by the ultrasonic velocity and attenuation measurements ....See Entry 119993

Photoacoustic spectra of natural apatites in the near ultraviolet and visible regions ....See Entry 121214

62.80 ULTRASONIC RELAXATION

(see also 74.30G Ultrasonic attenuation in superconductors, 43.35 Ultrasonics)

119117 Investigation of relaxation processes in the p-n junction region in the ultrasonic wave field. E.Garshka, K.Sakalauskas (Phys. Dept., Vilnius State Univ., Vilnius, USSR).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.5-6, p.377-9 (1983).
Acoustic wave interacting with a space charge of the p-n junction changes some of its parameters. These changes find application in the technique of developing instruments based on the interaction between the acoustic wave and the p-n junction. The physical model of such interaction requires a series of investigations. Some information can be obtained from the immediate measurements of the effective lifetime τ and the stored charge value Q in the region of the injection junction on the exposure of junction to the high-frequency ultrasonic wave. The authors list the results of measurements of the parameters τ and Q in the region of the Se and Si p-n junction as acoustic waves are being propagated via them. The results of the measurements point to the possibility of acoustic modulation of the space charge in the junction region. Relations of τ and Q to the injection charge value and the intensity of the acoustic field have been obtained. (1 ref.)

Acoustical study of aqueous solutions of sodium sulphate and thiosulphate ....See Entry 119107

63.00 LATTICE DYNAMICS AND CRYSTAL STATISTICS

(see also 05.50 Lattice theory, 65. Thermal properties, 66.70 Thermal conduction, 68.30 Dynamics of surface and interface vibrations, 78.30 Infrared and Raman spectra)

63.10 GENERAL THEORY

119118 Dynamics of the Toda lattice: a soliton-phonon phase-shift analysis. N.Theodorakopoulos, F.G.Mertens (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Phys. Rev. B (USA), vol.28, no.6, p.3512-19 (15 Sept. 1983).
The dynamics of the Toda lattice can be described in terms of solitons and nonlinear phonons (ripples). The latter are shown to be obtainable from a general multisoliton solution by allowing the soliton parameters to become imaginary. This device yields phonon phase shifts due to a soliton via a linearization procedure and shows that the zone-edge phonon (standing wave) is removed in the presence of a soliton. An expansion of the soliton-ripple solution up to the second order in the phonon amplitude allows the calculation of typical nonlinear quantities such as momentum and mass of the ripple and the spatial shift of a soliton due to its collision with a ripple. Finally, the relationship is established between the form of a ripple, viewed as a phonon wave packet, and its associated action variable within the framework of inverse scattering theory. (10 refs.)

63.20 PHONONS AND VIBRATIONS IN CRYSTAL LATTICES

119119 Phonons, phonon focusing, and helicon-phonon interaction. K.S.Viswanathan (Dept. of Phys., Kerala Univ., Trivandrum, India).
Curr. Sci. (India), vol.52, no.15, p.695-703 (5 Aug. 1983).
The author discusses phonons, elastic waves in crystals, internal conical refraction of acoustic waves, Faraday rotation of acoustic shear modes, helicons and helicon-phonon interactions, phonon focusing in crystals, second sound, solitons and ballistic pulses. (33 refs.)

119120 Lattice-dynamical evaluation of temperature factors in non-rigid molecular crystals: a first application to aromatic hydrocarbons. C.M.Gramaccioli (Istituto di Mineralogia, Univ. di Milano, Milano, Italy), G.Filippini.
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.784-91 (1 Sept. 1983).
Evaluation of temperature factors from a harmonic lattice-dynamical theory of molecular crystals has been applied to some aromatic hydrocarbons in the non-rigid case: i.e. mixing of lattice vibrations with the lowest-frequency internal modes. The calculations start from known atomic coordinates, unit-cell parameters and symmetry operations, using Califano-Neto potentials for inplane modes, Williams IVa potentials for intermolecular interactions, and an overall value of 0.9 nN Å for any twisting around C-C bonds. Molecular motions inside the crystal are described on the basis of normal coordinates of the isolated molecule, by applying Gwinn's method. (41 refs.)

119121 Instability of polaritons driven by infrared laser light. Ke-Hsuch Li (Inst. of Phys., Chinese Acad. of Sci., Beijing, China).
Phys. Lett. A (Netherlands), vol.97A, no.7, p.297-300 (12 Sept. 1983).
The nonlinear behavior of lattice vibrations driven by a coherent electromagnetic wave on the basis of Huang's equations is discussed. Under certain conditions formulated in the text these mixed electromagnetic lattice waves (polaritons) become unstable for some regions of the parameters of the incident laser light. Unstable motion of crystal lattices may be considered as a damage mechanism of the crystal structure. (9 refs.)

119122 Effect of electric field on the lattice viscosity of doped displacive ferroelectrics. R.P.Gairola, M.K.Gupta (Dept. of Phys., Univ. of Garhwal, Garhwal, India).
Phys. Rev. B (USA), vol.28, no.5, p.2775-84 (1 Sept. 1983).
A general expression for the lattice viscosity in doped displacive ferroelectrics, in the presence of an external electric field, is obtained using the double-time thermal Green's-function technique. The mass and force-constant changes between the impurity and host-lattice atoms are taken into account in the Silverman Hamiltonian augmented with higher-order anharmonic and electric moment terms. The defect-dependent, electric-field-dependent and anharmonic contributions to the lattice viscosity are discussed separately. It is shown that the lattice viscosity tensor, which is the sum of two terms arising from acoustic and optical phonons, can be further separated into diagonal and nondiagonal parts. The nondiagonal contribution vanishes in the absence of defects. The frequency and temperature dependences of the viscosity tensor are also discussed. (20 refs.)

119123 Renormalization of the *H*-point phonon anomaly in molybdenum. C.-L.Fu, K.-M.Ho, B.N.Harmon (Ames Lab., USDOE, Ames, IA, USA), S.H.Liu.
Phys. Rev. B (USA), vol.28, no.6, p.2957-61 (15 Sept. 1983).
The frequency of the *H*-point phonon of molybdenum obtained from precise frozen-phonon calculations differs from the experimental value by 9%. An analysis of this unusually large discrepancy shows that nonadiabatic effects are small, while effects caused by the many-body renormalization of electronic states near the Fermi energy are of the same order of magnitude as the discrepancy. (19 refs.)

119124 Lattice dynamics of incipient ferroelectric rutile TiO_2. F.Gervais (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany), W.Kress.
Phys. Rev. B (USA), vol.28, no.6, p.2962-8 (15 Sept. 1983).
Phonon dispersion curves in rutile TiO_2 have been calculated with a rigid-ion model and a shell model. The shell model closely reproduces experimental data. The hardening of soft ferroelectric Γ_1^- and Γ_5^+ TO modes with increasing temperature, which is observed experimentally, is found to be due to a small simultaneous decrease in effective ionic charge and oxygen polarizability. The decrease in both quantities can be understood in terms of fourth-order inter-ion and oxygen core-shell anharmonic interactions. (21 refs.)

119125 Lattice dynamics of thin ionic slabs. I. The electrostatic energy. G.Kanellis, J.F.Morhange, M.Balkanski (Lab. de Phys. des Solides, Univ. Pierre et Marie Curie, Paris, France).
Phys. Rev. B (USA), vol.28, no.6, p.3390-7 (15 Sept. 1983).
The electrostatic energy per cell for thin slabs of ionic crystals is calculated as a function of the thickness of the slab, its orientation and the position of the cell with respect to the surfaces. The summation method used is simple and quite general to allow for direct application to slabs of any structure. The depolarization field associated with slabs of certain orientations is also calculated and discussed. Numerical results are given for slabs of the zinc-blende and rocksalt structures. (4 refs.)

119126 Lattice dynamics of thin ionic slabs. II. The long-range forces. G.Kanellis, J.F.Morhange, M.Balkanski (Lab. de Phys. des Solides, Univ. Pierre et Marie Curie, Paris, France).
Phys. Rev. B (USA), vol.28, no.6, p.3398-3405 (15 Sept. 1983).
For pt.I see ibid., vol.28, p.3390 (1983). The Coulomb interaction is calculated for thin ionic slabs of any structure and orientation. For ions lying on different planes, parallel to the plane of the slab, the direct-space double sum is transformed into a rapidly converging double sum in reciprocal space only, while for ions lying on the same plane, a two-dimensional version of Ewald's method is used. Finally the authors comment on the macroscopic field associated with long-wavelength vibrations of an infinite lattice on the basis of a two-dimensional summation method. (6 refs.)

119127 Lattice dynamics of thin ionic slabs. III. Application to GaAs slabs. G.Kanellis, J.F.Morhange, M.Balkanski (Lab. de Phys. des Solides, Univ. Pierre et Marie Curie, Paris, France).
Phys. Rev. B (USA), vol.28, no.6, p.3406-14 (15 Sept. 1983).
For pt.II see ibid., vol.28, p.3398 (1983). The lattice vibrations of thin slabs (up to 25 layers) of GaAs are calculated for zero wave vector, on the basis of a rigid-ion model fitted on the phonon dispersion curves of the infinite crystal. It is shown that all the modes, except the surface ones, fall on the branches of the dispersion curves of the infinite crystal, while the surface modes seem to be combinations of those missing near the one-edge modes. Comparison is made with former calculations and the influence of the short-range interaction near the surfaces and that of possible macroscopic fields is discussed. (18 refs.)

The temperature dependence of coherent two-photon processes in naphthalene in the strong exciton-photon coupling regime .... See Entry 118206

Hydrogen bond formation and anion ordering in superconducting $(TMTSF)_2ClO_4$ and $(TMTSF)_2AsF_6$ .... See Entry 119003

Hydrate to pseudohydrate transformation in $Cd(ClO_4)_2.6H_2O$: An IR study .... See Entry 119187

Thermal conductivity of an imperfect anharmonic crystal .... See Entry 119289

Bonding in hydrogenated hard carbon studied by optical spectroscopy .... See Entry 119369

New approach to the exciton-phonon problem .... See Entry 119461

Physical properties of a new highly conducting TCNQ salt: $MPht(TCNQ)_2$ .... See Entry 119580

Isomer shifts and force constants of substitutional ^{119}Sn impurity atoms in FCC metals .... See Entry 119955

Temperature depedence of the electric field gradient in $AgIn_2$ intermetallic compound .... See Entry 119959

Use of CuO in obtaining approximate depolarization ratios of colorless solids .... See Entry 120038

Characterization of transplutonium orthophosphates and trimetaphosphates by Raman spectrophotometry .... See Entry 120045

Vibrational study of the $[P_2S_6^{4-}]$ anion, of some MPS_3 layered compounds (M=Fe, Co, Ni, $In_{2/3}$), and of their intercalates with $[Co(\eta^5\text{-}C_5H_5)_2^+]$ cations .... See Entry 120046

Infrared spectra of Cs_3CoCl_5 .... See Entry 120047

Far-infrared properties of $(TMTSF)_2ClO_4$ at low temperatures .... See Entry 120068

Far infrared properties of $(TMTSF)_2ClO_4$ .... See Entry 120069

Peierls instability of the organic linear chain semiconductor TEA $(TCNQ)_2$ [Raman study] .... See Entry 120070

Vibrational spectroscopy of mixed stack organic semiconductors: comparison with segregated stack systems .... See Entry 120076

Raman scattering resonant with quasi-two-dimensional excitons in semiconductor quantum wells .... See Entry 120080

Interference between allowed and forbidden Raman scattering by longitudinal-optical phonons in GaAs .... See Entry 120081

Water overtone and combination bands in the near-infrared spectrum of $M_2FeCl_5.H_2O$ (M=Cs,K) at cryogenic temperatures .... See Entry 120093

Raman scattering and symmetry of vibrational modes in SnI_4 crystals .... See Entry 120099

Extended X-ray-absorption fine-structure study of anharmonicity in CuBr .... See Entry 120184

63.20D Phonon states and bands, normal modes, and phonon dispersion

119128 Lattice vibrations in rare gas crystals. D.Singh, R.P.S.Rathore (Dept. of Phys., RBS Coll., Agra, India).
Acta Phys. Pol. A (Poland), vol.A64, no.3, p.263-8 (Sept. 1983).
The lattice dynamical model due to Massa et. al. (1979) is augmented for the inclusion of (a) the long range Van der Waal's interaction and (b) three body overlap terms. The elastic behaviour and the dispersion relations for the four rare gas crystals, i.e. neon, argon, krypton and xenon are predicted by modified versions and are compared with (a) the experimental findings and (b) the results of Massa et al. It is found that the model due to Massa et al. when supplemented with the Van der Waal's and three body terms proves to be more reliable and effective. (14 refs.)

119129 Inelastic scattering of slow neutrons in tin. M.Zivanovic, V.Spasojevic (Boris Kidric Inst. of Nuclear Sci., Belgrade, Yugoslavia).
Fizika (Yugoslavia), vol.15, no.3, p.233-7 (July-Sept. 1983).
The time-of-flight spectra of inelastically scattered cold neutrons on tin were investigated at 163, 225, 293, 468, 523 and 543K. A typical temperature dependence of the phonon population has been found, as well as the spreading of the phonon peaks in the liquid phase. The phonon spectrum of tin shows typical features of metal spectra. (5 refs.)

119130 On the effect of the correlation in phonon motion on the viscosity of impure dielectrics. A.G.Kozorezov (Dept. of Theoretical Phys., Univ. of Oxford, Oxford, England).
Phys. Lett. A (Netherlands), vol.97A, no.9, p.399-403 (26 Sept. 1983).
The effect of the correlation in phonon motion on the viscosity of impure dielectrics is studied. It is shown that for perfect dielectrics the relaxation times entering the expressions for the absorption of longitudinal and transverse acoustic waves are different due to phonon correlations. The influence of impurities on the viscosity of dielectrics is discussed. Special emphasis is given to the problem of longitudinal-acoustic-wave absorption in impure dielectrics. It is shown that the effect of impurities on phonon correlations can lead to a substantial change in absorption of longitudinal waves. (25 refs.)

119131 Neutron spectroscopy of phonons in stage-1 rubidium-intercalated graphite. W.A.Kamitakahara (Kernforschungzentrum Karlsruhe, Inst. fur Angewandte Kernphys. I, Karlsruhe, Germany), N.Wada, S.A.Solin, L.M.Seaverson.
Phys. Rev. B (USA), vol.28, no.6, p.3457-64 (15 Sept. 1983).
Neutron scattering measurements have been carried out on the graphite intercalation compound RbC_8. Phonon dispersion curves were measured for *c*-axis longitudinal modes and for some transverse branches with wave vectors in the basal plane and polarization out of plane. For the latter, there is a strong deviation of the dispersion relation from that of pure graphite. In addition, a partial phonon density of states was determined for intercalate (Rb) vibrations by in-basal-plane inelastic scattering. The authors analysis shows that a two-dimensional (2D) Born-von Karman model with nearest-neighbor Rb-Rb force constants cannot account for the intercalate mode spectrum. A three-dimensional model in which the Rb-Rb forces are due to an unscreened Coulomb interaction agrees well with the data, implying that conduction-electron screening of the Rb-ion motions is substantially reduced in RbC_8 relative to Rb metal. (34 refs.)

119132 Unified study of the lattice-mechanical properties of copper halide crystals. S.Chatterjee (Phys. Dept., Presidency Coll., Calcutta, India), S.Ghosh, A.N.Basu.
Phys. Rev. B (USA), vol.28, no.6, p.3534-49 (15 Sept. 1983).
The copper halide crystals, namely CuI, CuBr, and CuCl, though they have predominantly ionic binding, possess zinc-blende structure, and crystals having this structure have, in general, rather significantly low ionicity. This peculiarity is attendant with a number of unusual properties of this group of solids, and the various attempts to understand them in terms of the existing models show certain problems. Recently the authors have developed a general energy expression for an assembly of ions occupying an arbitrary configuration from a microscopic analysis of the problem. Inspection of the energy expression shows that within the S^2 approximation (up to and including second-order exchange) the following distortions are allowed: the two types of short-range dipolar deformations apart from the long-range dipolar one, scalar, and quadrupolar deformations. A model based on this energy expression has been employed to make a unified study of the different lattice-mechanical properties of the three copper halides. The specific properties that the authors have tried to correlate are the cohesive energy, the elastic and the dielectric properties, and the dispersion of phonons with the same set of parameters for each crystal.. Finally, the results for the different crystals and the possible sources of the remaining discrepancies are discussed. (36 refs.)

119133 Lattice vibrations in potassium based on an electron-gas-Morse potential. K.Mohammed, M.M.Shukla, F.Milstein, J.L.Merz (Univ. of California, Santa Barbara, CA, USA).
Solid State Commun. (USA), vol.48, no.2, p.147-50 (Oct. 1983).
Phonon dispersion relations and the Debye temperature of potassium are studied. The model employed in the study uses Morse potential for ion-ion interaction. In order to take into account the effect of conduction electrons, the authors have also included an electron-ion interaction term. By using this novel scheme, they were able to compute phonon frequencies which gave extremely satisfactory agreement with the observed data. (21 refs.)

119134 Analytical solution of the inverse spectrum problem for the A_3B lattice dynamics model. A.F.Maksimov.
Sov. Phys.-Solid State (USA), vol.25, no.3, p.541-3 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.939-41 (March 1983). [received: Oct. 1983]
A method is described for the calculation of parameters in the A_3B composite lattice dynamics model from the experimental dispersion curves by means of an extended system of compatibility equations. This approach yields explicit theoretical expressions to solve the inverse problem. (5 refs.)

Lattice dynamics of incipient ferroelectric rutile TiO_2 ....See Entry 119124

Frequency spectrum, specific heat and Debye temperature of α-iron ....See Entry 119143

X-ray investigation of the mean square thermal displacements in VD_x, NbH_x and TaH_x interstitial alloys ....See Entry 119145

Thermal conductivity of lead sulfide-based solid solutions ..... See Entry 119285

Influence of transverse motion quantization on the normal vibration spectrum of a two-dimensional Wigner lattice .... See Entry 119487

Relationship between the pyroelectric coefficient and the lattice dynamics of the pyroelectrics ....See Entry 119988

An investigation of the far infrared optical properties of $Hg_{1-x}Cd_xTe$ ....See Entry 120042

Raman scattering in $Hg_{0.8}Cd_{0.2}Te$ .... See Entry 120043

Effect of an electric field on the low frequency Raman spectrum of $KNbO_3$ ....See Entry 120078

Raman scattering, defect luminescence, and phonon spectra of ^7LiH, ^6LiH, and ^7LiD crystals ....See Entry 120088

Structure of vibrational spectra of $Cd_{1-x}Hg_xTe$ solid solutions ....See Entry 120096

Lattice reflection spectra of TlS_xSe_{1-x} solid solutions ....See Entry 120098

63.20H Phonon-phonon interactions

Thermal conductivity of crystals: a molecular-dynamics study of heat flow in a two-dimensional crystal .... See Entry 119288

An investigation of the far infrared optical properties of $Hg_{1-x}Cd_xTe$ ....See Entry 120042

63.20K Phonon-electron interactions

119135 Anisotropy of the piezoelectric electron-phonon interaction in wurzite semiconductors. D.Dunn (J.J. Thomson Phys. Lab., Univ. of Reading, Reading, England).
J. Phys. C (GB), vol.16, no.28, p.5427-33 (10 Oct. 1983).
Explicit (and exact) expressions are derived for the electron-phonon interaction parameters describing the interaction of conduction electrons and long-wavelength piezoelectric phonon modes in wurzite semiconductors. The effect of the anisotropy of the interaction is demonstrated by calculating the electron self-energy and spectral density. Both functions show a strong angular dependence in contrast to the predictions of the 'isotropic model' of piezoelectric scattering. (12 refs.)

119136 Electron-phonon coupling in KCP. I.Baldea, M.Apostol (Dept. of Theoretical Phys., Central Inst. of Phys., Bucharest-Magurele, Rumania).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1557-60 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
A model is proposed for the electron-phonon coupling in the 1d distorted lattice which accounts for the data in KCP. (6 refs.)

119137 Cooperation of free- and bound-electron-phonon scattering in Sb-doped Ge. S.R.Singh, S.Singh (Dept. of Phys., Udai Pratap Post-Graduate Coll., Uttar Pradesh, India).
Phys. Rev. B (USA), vol.28, no.6, p.3386-9 (15 Sept. 1983).
The cooperation of free- and bound-electron-phonon scatterings are studied in detail for Sb-doped Ge in the intermediate range of donor concentrations. It has been shown that the cooperation of free- and bound-electron-phonon scatterings in the intermediate range of donor concentrations explains the anomalous variation of the phonon-conductivity ratio $\mathcal{K}_D/\mathcal{K}_P$ (doped to pure host) with temperature for Sb-doped germanium which could not be explained so far by previous workers. (12 refs.)

The contrast of defects in inelastically scattered electrons .....See Entry 118824

The 'tilt' effect in the absorption of ultra-sound by metals in a low magnetic field .... See Entry 119115

Heating and mutual drag of charge carriers and phonons in nondegenerate Kane semiconductors in strong electric and quantizing magnetic fields ....See Entry 119633

Theory of phonon sideband resonances in Raman scattering from semiconductors ....See Entry 120087

63.20M Phonon-defect interactions

Lattice thermal conductivity of crystals with dislocations ...... See Entry 119287

63.20P Localized modes

119138 Influence of random strain fields on the frequency distribution of degenerate local vibrations. M.A.Ivanov, A.Ya.Fishman (Inst. of Metall., Acad. of Sci., Sverdlovsk, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.546-7 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.946-8 (March 1983). [received: Oct. 1983]
Strain fields due to the presence of point defects in a crystal cause a considerable broadening of the local vibration frequencies. The authors deal with the distribution functions for doubly and triply degenerate local vibrations, for which the resultant frequency distribution is due to the lifting of the degeneracy by many-component random strain fields. (5 refs.)

Carbon-related vibronic bands in electron-irradiated silicon ...See Entry 119070

Raman scattering in $Hg_{0.8}Cd_{0.2}Te$ .... See Entry 120043

Influence of an external environment on the vibrational spectra of SeO_3^{2-} and SO_3^{2-} impurity anions in KCl and KBr crystals ....See Entry 120097

Boron impurity anti-site defects in p-type gallium-rich gallium arsenide ....See Entry 120116

63.50 VIBRATIONAL STATES IN DISORDERED SYSTEMS

119139 Nonlinearity parameter and its relationship with thermo-acoustic parameters of polymers. B.K.Sharma (Phys. Dept., Regional Coll. of Education, Bhubaneswar, India).
J. Phys. D (GB), vol.16, no.10, p.1959-65 (14 Oct. 1983).
A relationship between the isobaric, isothermal and isochoric lattice Gruneisen parameters has been examined and analysed for several polymers. Relationships between the various parameters describing the thermo-acoustic and nonlinear properties of polymers are developed and their relations with thermo-acoustic data established. It is shown that the isochoric temperature derivative of the sound speed or bulk modulus is the dominant factor, with a significant contribution to the thermo-acoustic properties. Using this simple model, Beyer's parameter of nonlinearity, thermo-acoustic parameters, molecular constant, Huggins parameter and the lattice Gruneisen parameters are shown to be related to each other. Calculated data on these parameters for eight polymers are presented. The results have been used to develop further understanding of the significance of microscopic factors such as molecular order and intermolecular interactions, upon macroscopic thermo-acoustic properties in polymers. A new dimensionless thermo-acoustic parameter S_0^* expressed in terms of volume expansivity only has been introduced, which gives, on an average, a constant value of 1.06 in polymers. (20 refs.)

119140 Dynamics and vibrational spectroscopy of doped polyacetylene as one dimensional disordered crystal. G.Zerbi, G.Zannoni (Politecnico di Milano, Milano, Italy).
J. Phys. Colloq. (France), vol.44, no.C-3, p.273-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The vibrational spectra of doped and undoped trans-polyacetylene are analyzed with the help also of model molecules such as β-carotene. Results from lattice dynamical calculations are reported. The spectroscopic points which are still controversial are presented. (20 refs.)

119141 Density of vibrational states of chemically and structurally disordered polyacetylene. G.Zannoni, G.Zerbi (Dipartimento di Chimica Industriale e Ingegneria Chimica, Politecnico di Milano, Milano, Italy).
J. Phys. Colloq. (France), vol.44, no.C-3, p.503-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Normal mode calculations on two possible kinds of chemical disorder in trans-PA are presented. These chemical defects show characteristic localized modes, which seem to find corresponding bands in the vibrational spectra. Comparison with the literature data indicates that the vibrational assignment of trans-PA is still quite uncertain. (7 refs.)

119142 Peierls instability and vibrational spectra of polyacetylene. A.A.Ovchinnikov (Karpov Inst. of Phys. Chem., Moscow, USSR), A.Belinskii, I.A.Misurkin, I.I.Ukrainskii.
J. Phys. Colloq. (France), vol.44, no.C-3, p.511 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Summary form only given, as follows. It is shown that the Peierls instability in conjugated polymers is modified by the interaction of π-electrons. This modification gives rise to the absence of a soft mode of stretching C-C vibrations. Taking into account electron correlations the authors obtain a reasonable agreement between the calculated and measured frequencies of carbon skeleton of polyacetylene with all the C-C bonds being equal in length. In is shown that the conclusion of the bond length alternation in polyacetylene does not follow from the experimental data on the vibrations of polyacetylene. (2 refs.)

Structure of dense cross-linked polymers of dimethacrylates and oligo-n-methacrylates ....See Entry 118921

Thermostimulated creep study of undoped polyacetylene $(CH)_x$ films ....See Entry 119099

Inelastic scattering of slow neutrons in tin ....See Entry 119129

Low temperature thermal expansion of soda-borate glasses ...See Entry 119237

The effect of vibronic transition on the interband optical-absorption in $(CH)_x$ ....See Entry 119999

Photo induced infrared active phonons in trans polyacetylene ....See Entry 120059

Dispersion curves and resonant Raman spectrum of trans polyacetylene ....See Entry 120060

Optical properties of heavily doped polyacetylene films ....See Entry 120063

Vibrational spectra and structure of undoped and doped polyparaphenylene ....See Entry 120066

Raman studies of vitreous SiO_2 versus fictive temperature .....See Entry 120085

63.70 STATISTICAL MECHANICS OF LATTICE VIBRATIONS

(see also 65. Thermal properties of condensed matter, 66.70 Thermal conduction)

119143 Frequency spectrum, specific heat and Debye temperature of α-iron. O.P.Gupta (Phys. Dept., J. Christian Coll., Allahabad, India).
Acta Phys. Pol. A (Poland), vol.A64, no.3, p.269-76 (Sept. 1983).
The frequency spectrum, specific heat and Debye temperature of α-iron have been calculated on the basis of recent lattice dynamical model. The computed values are compared with the available experimental data. The theoretical results are in reasonable agreement with the experimental values. (59 refs.)

119144 Excess Gruneisen parameter and intermolecular interaction in binary liquid mixtures of trichloroethylene. B.P.Shukla, V.N.Mishra, S.N.Dubey (Dept. of Chem., Nat. Degree Coll., Gorakhpur, India).
Curr. Sci. (India), vol.52, no.15, p.721-3 (5 Aug. 1983).
The Gruneisen parameter (Γ), which is a dimensionless measure of change in entropy with volume or thermal pressure, has been extended to liquid state for investigating the internal structure, clustering phenomena and remaining

quasicrystalline lattice nature. By using some thermodynamic relations, Γ can be expressed by the relation: $\Gamma=C^2\ \alpha/C_p=\gamma-1/T\alpha$, where C, α, C_p and γ represent sound velocity, thermal expansion coefficient, principal heat capacity at constant pressure and heat capacity ratio respectively. The sum of exponents of Mies' equation has been determined for liquid mercury, using Gruneisen number, assuming a condensed system of molecules and consisting of harmonic oscillators. The Gruneisen parameter has been extended to binary liquid mixtures and the value of excess Gruneisen parameter has been calculated using the relation $\Gamma^E=\Gamma_{mix}-\Sigma_{i=0}{}^2 x_i\Gamma_i$. (12 refs.)

119145 X-ray investigation of the mean square thermal displacements in VD_x, NbH_x and TaH_x interstitial alloys. H.Behr, H.M.Keppler, G.Steyrer, H.Metzger, J.Peisl (Sektion Phys., Ludwig-Maximilians Univ. Munchen, Munchen, Germany).
J. Phys. & Chem. Solids (GB), vol.44, no.10, p.985-9 (1983).
X-ray measurements of the integrated Bragg intensities from V, Nb and Ta single crystals as a function of hydrogen (D) concentration and temperature have been carried out. Two different methods were applied: (i) the usual angular dispersive method using $MoK_{\alpha 1}$ characteristic radiation; and (ii) the energy dispersive method using the white spectrum of the Mo tube and an intrinsic Ge detector. From the results the thermal Debye-Waller factor for the three metals and its change with hydrogen concentration are determined. The mean square of the thermal displacements $\langle u^2\rangle$ decreases with hydrogen (D) concentration. For $NbH_x(D_x)$ this agrees well with $\langle u^2\rangle$ values as determined from measured phonon density of states spectra. The results are also given in terms of a Debye temperature depending on H(D) concentration. (16 refs.)

Lattice vibrations in potassium based on an electron-gas-Morse potential .... See Entry 119133

Nonlinearity parameter and its relationship with thermo-acoustic parameters of polymers .... See Entry 119139

Pressure-induced phase transition in β-$LiIO_3$ .... See Entry 119183

Some Monte Carlo calculations for the Lennard-Jones solid .... See Entry 119229

Thermal expansion of organic conductors .... See Entry 119236

Low temperature thermal expansion of soda-borate glasses ... See Entry 119237

Thermal expansion and isothermal compressibility of thallium telluride .... See Entry 119238

Lattice thermal conductivity of crystals with dislocations ...... See Entry 119287

Thermal conductivity of an imperfect anharmonic crystal ...... See Entry 119289

Isomer shifts and force constants of substitutional ^{119}Sn impurity atoms in FCC metals .... See Entry 119955

63.75 STATISTICAL MECHANICS OF DISPLACIVE PHASE-TRANSITIONS

(for order-disorder and statistical mechanics of model systems, see 64.60; for crystallographic aspects of polymorphic and order-disorder transformations, see 61.50K)

Soft modes of crystals belonging to the SbSI-SbSBr system . See Entry 119146

The α-β transition of quartz; a view of some current problems: order-disorder or displacive transition, thermodynamic behaviour .... See Entry 121212

63.90 OTHER TOPICS IN LATTICE DYNAMICS AND CRYSTAL STATISTICS

119146 Soft modes of crystals belonging to the SbSI-SbSBr system. V.Kalesinskas, I.Grigas, V.Paprotnyi, V.Spitsyna (State Pedogogical Inst., Vilnius, Lithuanian SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.421-6 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.738-45 (March 1983). [received: Oct. 1983]
The dielectric spectra $\epsilon'(\nu,T)$ and $\epsilon''(\nu,T)$ of SbSI-SbSBr crystals were investigated in the frequency range from 8 to 80 GHz. A resonance of the dielectric dispersion was observed in the paraelectric phase and this attributed to a soft overdamped mode of frequency in the microwave range. The dispersion parameters of soft modes were determined for crystals of this system and their temperature dependences were found. The microwave soft mode dominated the static permittivity and was responsible for its variation in accordance with the Curie-Weiss law. It was found that this microwave soft mode was additional to the familiar phonon modes and that phase transitions in these crystals were intermediate between displacive and order-disorder transitions. (33 refs.)

Theory of the structural phase transition in A15 compounds .... See Entry 119182

64.00 EQUATIONS OF STATE, PHASE EQUILIBRIA, AND PHASE TRANSITIONS

(see also 82.60 Chemical thermodynamics)

64.10 GENERAL THEORY OF EQUATIONS OF STATE AND PHASE EQUILIBRIA

119147 Calculation and representation of phase equilibria in multicomponent systems. E.-Th.Henig, U.Kattner, G.Petzow (Max-Planck-Inst. fur Metallforschung, Inst. fur Werkstoffwissenschaften, Stuttgart, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.769-76 (Sept. 1983).
The general features of thermodynamic calculation of phase equilibria are reviewed. This includes analytical description of the thermodynamic functions by approximations or models, determination of the resulting adjustable coefficients from experimental data, calculation of phase equilibria based on the Gibbs free energy functions of individual phases and graphical representation of the results. Special emphasis is given to different types of two-dimensional representations only containing partial information about the multidimensional higher order systems. (35 refs.)

64.30 EQUATIONS OF STATE OF SPECIFIC SUBSTANCES

(see also 65.70 Thermal expansion)

Compatibility among chlorinated polyethylenes .... See Entry 119211

Thermodynamic aspects of mechanical behavior of glassy polymers .... See Entry 120366

64.60 GENERAL STUDIES OF PHASE TRANSITIONS

(for critical phenomena in quantum fluids, superconductors, magnetic materials and ferroelectrics, see 67., 74.40, 75.40 and 77.80 respectively)

119148 Application of thermodynamic models in phase diagram assessment. M.Hillert (Div. of Phys. Metall., Royal Inst. of Technol., Stockholm, Sweden).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.762-9 (Sept. 1983).
By the use of examples which mainly concern the configurational entropy of alloy systems at attempt is made to illustrate the application of physical and mathematical models to the assessment of alloy systems. It is emphasized that methods, which are often regarded as independent of models, depend very strongly on some hidden choice of a model. Different physical models can give the same mathematical model. For further developments it may be essential to test what physical model gives the most realistic description of the situation in the real system. Different mathematical models can represent the data very well even when the properties of the system are very specific. (25 refs.)

119149 Theory of nucleation on charged cores. II. Thermodynamic parameters of an equilibrium nucleus. F.M.Kuni, A.K.Shchekin, A.I.Rusanov (Leningrad Univ., Leningrad, USSR).
Colloid J. USSR (USA), vol.44, no.6, p.935-41 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1062-8 (Nov.-Dec. 1982). [received: Sept. 1983]
For pt.I see ibid., vol.44, no.5 (1982). The dependence of the surface tension, the radius of the tension surface, the radius of the equimolecular surface, the absolute specific adsorption, the specific surface entropy, the surface polarization, the excess large thermodynamic potential, and the work for the formation of a nucleus on the magnitude and sign of its charge has been determined for a critical nucleus with an electric charge at its center. (4 refs.)

119150 Gravity-induced density and concentration profiles in binary mixtures near gas-liquid critical lines. R.F.Chang, J.M.H.Levelt Sengers (Thermophys. Div., NBS, Washington, DC, USA), T.Doiron, J.Jones.
J. Chem. Phys. (USA), vol.79, no.6, p.3058-66 (15 Sept. 1983).
The authors have calculated gravity-induced density and concentration gradients using scaled equations of state fashioned after that of Leung and Griffiths for binary mixtures near gas-liquid critical lines. The mixtures considered here are those of helium-3 and helium-4 and of carbon dioxide and ethane. The calculations show that the density profiles for both mixtures in any proportion of the components are similar to those of pure fluids. The concentration gradients in the helium mixture have the same appearance as the density gradients. In the carbon dioxide-ethane system, however, the form of the concentration profile varies greatly, depending on the overall composition. Moreover, the temperature at which a mixture separates into two phases is slightly different from that expected for the mixture in the absence of gravity. The authors have also examined the case where a mixture is subjected to a large gravitational field such as can be generated in a centrifuge and found that, although the density gradient in all the mixtures is like that in pure fluids, the concentration gradients in the mixtures of carbon dioxide and ethane have complex features related to the presence of critical azeotropy. (33 refs.)

119151 Quantum and thermal nucleation in polydiacetylene. S.Kivelson, J.P.Sethna (Dept. of Phys., State Univ. of New York, Stony Brook, NY, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.657-65 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
A simple continuum model of polydiacetylene (PD) is constructed and used to study the structural-phase-transition that occurs in certain PDs. It is concluded that the transition in ETCD-PD is thermally-nucleated while that in TCDU-PD is probably quantum-nucleated. (13 refs.)

119152 Incommensurate structure as a nonlinear resonance between an atomic chain and a field. P.I.Belobrov, A.G.Tret'yakov, G.M.Zaslavsky (Kirensky Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Phys. Lett. A (Netherlands), vol.97A, no.9, p.409-12 (26 Sept. 1983).
The general condition for the commensurate-incommensurate phase transition in an atomic chain is considered. The potential energy of atoms consists of a next-neighbour interaction and an external periodic field. This condition reveals itself in the so-called nonlinear resonance for an equivalent dynamical system. (12 refs.)

119153 Monte Carlo studies of a Laplacian roughening model for two-dimensional melting. K.J.Strandburg, S.A.Solla, G.V.Chester (Lab. of Atomic & Solid State Phys., Cornell Univ., Ithaca, NY, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2717-31 (1 Sept. 1983).
Monte Carlo simulations are used to study the thermodynamic properties of the Laplacian roughening model. Nelson has shown that this model is related via a duality transformation to a gas of disclinations in a two-dimensional solid, and mimics the positional and orientational symmetries relevant to two-dimensional melting. In the authors' simulations thermodynamic functions vary continuously over the full temperature range and agree with analytic results at low and high temperatures. Correlation functions exhibit three distinct regimes as a function of temperature and yield strong evidence for the existence of an intermediate phase characterized by short-range positional order and quasi-long-range orientational order. The Monte Carlo results are in quantitative agreement with the predictions of the Kosterlitz-Thouless-Halperin-Nelson-Young theory and establish the existence of two successive continuous phase transitions for the Laplacian roughening model. The corresponding transition temperatures are obtained from the temperature dependence of the renormalized elastic constant K_R and the Frank constant K_A. (21 refs.)

119154 Doubled-incommensurate phase transition in quasione-dimensional systems. A.I.Buzdin, V.V.Tugushev (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.506-7 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.882-4 (March 1983). [received: Oct. 1983]
The authors study the phase diagram of the insulating state of a quasione-dimensional system with a nearly half-filled band $|c\text{-}1| \ll 1$ (c is the number of electrons per unit cell in the metallic phase). Umklapp scattering is then important. If $n < n_c$ [the density is given by $n = |c\text{-}1|/a$, where $n_c = 1.208\Delta_0 N(0)$; a is the lattice constant; Δ_0 is the gap in the spectrum of the doubled phase at $T=0$; and $N(0)$ is the density of states], a transition to a state with a doubled period $q = \pi/a$ takes place rather than to a state with a static strain $q = 2k_F$. (7 refs.)

Competing criticality of short- and infinite-range interactions on the Cayley tree .... See Entry 117111

Continuum fluids with a discontinuity in the pressure .... See Entry 117132

Closed-loop phase diagrams, vaporization, and multicriticality in binary liquid mixtures .... See Entry 119157

Phase diagrams of surface structures from Bethe-ansatz solutions of the quantum sine-Gordon model .... See Entry 119158

Computation of phase transformations in heterogeneous solids .... See Entry 119189

Active-coupling mixing times for a stirred binary liquid .... See Entry 119209

Vortex motion and mutual friction in ^{3}He-^{4}He mixtures in the critical and tricritical regions .... See Entry 119300

Absence of critical wetting in systems with long-range forces .... See Entry 119313

Theory of anion ordering in TMTSF compounds .... See Entry 119438

Conductivity of heterocondensates of CdTe .... See Entry 119725

64.70 PHASE EQUILIBRIA, PHASE TRANSITIONS, AND CRITICAL POINTS

(see also 81.30 Phase diagrams and microstructures developed by solidification and solid-solid phase transformations)

119155 Phase transitions of binary mixtures in random media. F.Brochard, P.G.de Gennes (Coll. de France, Paris, France).
J. Phys. Lett. (France), vol.44, no.18, p.L785-91 (15 Sept. 1983).
The authors consider a porous solid, or a gel, saturated by a two fluid system A+B, in the limit where the thickness ξ of the AB interface is smaller than the pore size D. The solid prefers to be in contact with one of the fluids (A). But, if the chemical potential of B is decreased, the B fluid enters the structure. They discussed the reversible penetration process, and find two distinct modes: 'capillary invasion' with clusters of B regions growing progressively; 'flip process' where all pores are abruptly invaded by B (except possibly for a thin sheath of thickness ξ near the walls). The 'fields' H (=chemical potential changes) required to perform capillary invasion (H_c) or flip (H_f) are in ratio: $H_f/H_c \simeq (\xi/D)\exp(2-d_f)$ where d_f is the fractal dimension of the pore surface. Gels made with rod-like molecules have $d_f=1$, while flexible chains in good solvents have $d_f=5/3$. For all gels the flip process should dominate, and they expect a sharp transition. On the other hand, porous solids ($d_f=2$) require a special discussion. Modeling the pores as interconnected capillaries of random diameter D, they find that capillary invasion dominates in this case, and they expect no sharp transition. (18 refs.)

119156 The silver iodide-thallium iodide pseudo-binary system. J.W.Brightwell, L.S.Miller, A.Munday, B.Ray (Faculty of Appl. Sci., Coventry Polytech., Coventry, England).
Phys. Status Solidi a (Germany), vol.79, no.1, p.293-300 (Sept. 1983).
A form of the T-x section of the equilibrium phase diagram for the system AgI-TlI is proposed on the basis of thermal and X-ray diffraction data. Two room temperature stable intermediate phases $AgTlI_2$ and $AgTl_2I_2$ are confirmed, and evidence is found for two other phases, stable at higher temperatures. The electrical conductivity is determined principally by the fraction of AgI present; fast ion conduction occurred only when α-AgI was present. (16 refs.)

119157 Closed-loop phase diagrams, vaporization, and multicriticality in binary liquid mixtures. R.G.Caflisch (Dept. of Phys., MIT, Cambridge, MA, USA), J.S.Walker.
Phys. Rev. B (USA), vol.28, no.5, p.2535-46 (1 Sept. 1983).
The coupled Potts-Ising models of Walker and Vause, which successfully describe closed-loop phase diagrams in hydrogen-bonding mixtures, are generalized to encompass the vapor phase and are studied using positron-space renormalization-group techniques. Global phase diagrams are generated, exhibiting such features as miscibility-immiscibility criticality, liquid-vapor critical points, critical end points and bicritical and tricritical points. In addition, new types of phase diagrams are found, involving upper and lower azetotropes, for example, which are expected to be physically realizable in experimental systems. (38 refs.)

119158 Phase diagrams of surface structures from Bethe-ansatz solutions of the quantum sine-Gordon model. F.D.M.Haldane (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen, Denmark), P.Bak, T.Bohr.
Phys. Rev. B (USA), vol.28, no.5, p.2743-5 (1 Sept. 1983).
Phase diagrams of uniaxial two-dimensional systems with commensurate, incommensurate, and liquid phases are derived by combining exact results for the quantum sine-Gordon model with the Kosterlitz-Thouless theory of melting. The phase diagram depends on the order of commensurability, p. In particular, for $p=3$ (the 'chiral Potts' case), the authors conjecture that the phase diagram contains no Lifshitz point, in contrast to previous authors; for $p=1$, dislocations remove the original *CI* transition completely. (18 refs.)

119159 Study of the phase diagrams of graphite intercalation compounds. S.E.Millman, G.Kirczenow (Dept. of Phys., Boston Univ., Boston, MA, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3482-3500 (15 Sept. 1983).
The model of staging recently proposed by Millman and Kirczenow (1982) is used to survey the possible phase diagrams for graphite intercalation compounds. For a wide variety of intercalants, including the alkali metals and aromatic molecules, the model predicts the staged structures which are observed experimentally. The model also provides physical guidelines for identifying materials in which more complex structures, such as those predicted recently by Safran (1980), may be realized at high temperatures. The authors suggest a class of compounds, the transition-metal chloride, which may possibly meet these physical guidelines. If this complex staging is found, the model predicts rich and varied phase diagrams which are very sensitive to changes in the physical parameters. The authors also discuss some possible improvements to the model and show that the essential predictions of the model are not affected by these improvements. (12 refs.)

119160 A study of AgI-CuI-KI-RbI system using DTA and X-ray methods. I.V.Vasil'kova, I.I.Kozhina, M.D.Pyatunin, S.I.Stepanova.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.99-101 (Aug. 1983). In Russian.
The AgI-CuI-KI-RbI four component system has been investigated by thermographic and X-ray methods. The phase diagram has been constructed. (5 refs.)

Theory of crystal ordering: hexagonal symmetry .... See Entry 118931

Anion ordering in europium(II) mixed halide systems: preparation of mixed cation fluoride halides .... See Entry 118976

Enthalpy of formation and transformation in binary and ternary systems of the metals iron, cobalt, nickel and molybdenum .... See Entry 119232

Phase transitions in monolayers adsorbed on uniaxial substrates .... See Entry 119343

The low temperature P-T phase diagram of TTF-TCNQ .... See Entry 119577

Phase composition and phase stability of a high-chromium nickel-based superalloy, IN939 .... See Entry 120311

Phase fields and initial melting diagrams of the pseudoquaternary system UC-$MoC_{1-x}ZrC$-NbC .... See Entry 120312

On the Co-Ti system .... See Entry 120313

Experimental aspects of solid galvanic cell methods for thermodynamic studies on alloys .... See Entry 120314

Solid-state quaternary phase equilibrium diagram for the Hg-Cd-Te-O system .... See Entry 120316

Phase equilibria in the ZnO-CdO-Fe_2O_3 system with a concentration of Fe_2O_3 of less than 50 mole % .... See Entry 120317

Interaction in the system ZrO_2-MgO-$MgCr_2O_4$ .... See Entry 120318

Comments on 'Phase equilibria in the Mn_2O_3-Mn_3O_4-MnO system in CO_2-H_2 mixtures' .... See Entry 120319

An AEM investigation of the formation of precipitate-free zones in an Al-16 wt.% Ag alloy: determination of equilibrium and metastable solvus lines .... See Entry 120339

64.70D Solid-liquid transitions

(see also 81.30F Solidification)

119161 Investigation of the melting point of thin films as a method of determining their elastic energy. G.A.Ukhlinov, E.A.Kolesnik, V.N.Vigdorovich (Moscow Inst. of Electronic Engng., Moscow, USSR).
Ind. Lab. (USA), vol.48, no.12, p.1192-4 (Dec. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.12, p.38-40 (Dec. 1982). [received: Sept. 1983]
Investigation of the melting point of thin films is of scientific-methodological value for the determination of the excess enthalpy (internal energy) of the films. A method is proposed to determine the film melting point in a closed system with an electrical display of the instant of melting by the break in the electrical loop into which the film is connected in series. The specimen is a film of substance on a substrate. It is comprised of a substrate on a base and a cover pressed to its surface through a mica dielectric padding. A depression for insertion of the thermometer is made in the base of a copper block. Commutation of the film with the electrical loop is by molybdenum foil spring contacts fastened by bolts and nuts. (4 refs.)

119162 Preparation and melting point of octalithium zirconate. M.S.Ortman, E.M.Larsen (Dept. of Chem., Univ. of Wisconsin, Madison, WI, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.142-4 (Aug. 1983).
Octalithium zirconate was prepared by heating a pelletized stoichiometric mixture of fused lithium oxide and zirconium dioxide under a dynamic vacuum to 863K for 40 h. The melting point was determined to be 1568 ± 5K. Chemical inertness and high lithium atom density, 5.93×10^{22} atoms/cm^3, make octalithium zirconate a candidate for a solid tritium breeder. (11 refs.)

Direct microscopic and microholographic observations of the solidification of particles from rapidly stirred melts .... See Entry 117226

Simple conditions for the appearance of sustained oscillations in continuous crystallizers .... See Entry 118927

Characteristics of the crystals of derivatives of $12CaO.7Al_2O_3$ .... See Entry 118949

Theoretical considerations regarding pulsed laser annealing of a-Ge layers on GaAs .... See Entry 119061

Pulsed-laser annealing of GaAs surface studied by time-resolved second-harmonic generation in reflection .... See Entry 119062

Density of liquid $Hg_{1-x}Cd_xTe$ .... See Entry 119080

Monte Carlo studies of a Laplacian roughening model for two-dimensional melting .... See Entry 119153

Phase diagrams of surface structures from Bethe-ansatz solutions of the quantum sine-Gordon model .... See Entry 119158

Measured thermal diffusivity of $Hg_{1-x}Cd_xTe$ solids and melts .... See Entry 119284

Interaction in the K_2O-Mn_2O_3-P_2H_2O system at 140-400°C .... See Entry 120231

Mixed crystals based on antimony niobate in the Sb_2O_3-Nb_2O_5-Sb_2O_5-KHF_2-H_2O_2-H_2O system .... See Entry 120232

The use of metallic glasses in fabrication of ICF targets .... See Entry 120273

Thermal behaviour of poly(β-ketothioethers) .... See Entry 120307

Phase fields and initial melting diagrams of the pseudoquaternary system UC-$MoC_{1-x}ZrC$-NbC .... See Entry 120312

Mechanical properties of Sn-Ag_3Sn alloys .... See Entry 120320

Solidification and solid state transformations during cooling of chromium-molybdenum white cast irons .... See Entry 120321

Process and structural aspects of melt-spun nickel-based superalloy ribbons .... See Entry 120322

Microstructural modification of austenitic stainless steels by rapid solidification .... See Entry 120323

New-generation aluminium alloys through rapid solidification processing .... See Entry 120324

Residual stresses in plastics sheet and injection mouldings .... See Entry 120325

Electron microscopic investigations on a melt-quenched Al-Rh alloy ....See Entry 120333

Structure and properties of a rapidly quenched commercial Al-Mn alloy ....See Entry 120361

64.70F Liquid-vapour transitions

119163 Hydrogen bonding and other polar interactions of 1-,2-, and 4-octyne with organic solvents. J.H.Hallman, W.K.Stephenson, R.Fuchs (Dept. of Chem., Univ. of Houston, Houston, TX, USA).
Can. J. Chem. (Canada), vol.61, no.9, p.2044-7 (Sept. 1983).
The heats of vaporization of 1-octyne (10.11±0.02 kcal/mol), 2-octyne (10.63±0.03 kcal/mol), and 4-octyne (10.21±0.02 kcal/mol) have been determined. Heats of solutions of the liquid octynes and *n*-octane have been measured in heptane, cyclohexane, 1,2-dichloroethane, *n*-butyl ether, ethanol, triethylamine, dimethyl sulfoxide, butyrolactone, dimethyl-heptane, cyclohexane, 1,2-dichloroethane, *n*-butyl ether, ethanol, triethylamine, dimethyl sulfoxide, butyrolactone, dimethylformamide, and hexamethylphosphoric triamide. Enthalpies of transfer from vapor to each solvent have been calculated. Enthalpies of hydrogen bond formation, calculated by the pure base method, become more exothermic in the above solvent order. Correlations with the Taft-Kamlet solvent parameters π^* and β indicate that other polar interactions (presumably dipole-induced dipole) are appreciably larger for 1-octyne than for 2- and 4-octyne. (13 refs.)

119164 Synthesis of optimal and near-optimal distillation sequences by a bounding strategy. L.Pibouleau, A.Said, S.Domenech (Inst. du Genie Chimique, Toulouse, France).
Chem. Eng. J. (Switzerland), vol.27, no.1, p.9-19 (Aug. 1983).
The problem of synthesizing an optimal multicomponent separation flow sheet according to capital and operating expenses is solved by a branch and bound method. The lower bound used in the branch and bound procedure is defined with the help of a heuristic rule. The algorithm can find the optimal sequence and all the sequences whose costs are within a specified factor of the cost of the optimal sequence. The distillation columns are computed using a short-cut method, and the capital and operating expenses are calculated by the Guthrie method. A detailed example shows that the ratio of the number of explored sequences to the total number of possible sequences is always very low (less than 0.25) and that similar operating conditions (operating pressure and reflux ratio) usually give the same optimal sequence. Furthermore, the FORTRAN code of the method can be implemented using less than 32k bytes of central memory, so the program can be used on a microcomputer. (32 refs.)

119165 Experimental study of vapor-liquid relationships for binary system in high vacuum evaporation—DBP-DBS system. Y.Hagihara (Dept. of Chem, Nat. Defense Acad., Yokosuka, Japan).
Sci. & Eng. Rep. Natl. Def. Acad. (Jpn.) (Japan), vol.20, no.3, p.253-64 (Nov. 1982). In Japanese. [received: Aug. 1983]
Measurements of the vapor-liquid relationships for DBP-DBS system were made in a range or residual air pressure from 1.0×10^{-3} to 3.5×10^{-1} mmHg by using an agitator vessel. Based on the experimental results, the effects of residual air pressure and liquid surface temperature on the vapor-liquid relationship in a high vacuum evaporation are clarified. An empirical formula was also derived which showed approximate agreement with the vapor-liquid relationship for a binary system. (8 refs.)

119166 On concentration dependence of partition coefficients between liquid and gas phases. B.V.Ioffe, V.V.Larionov, A.N.Marinichev.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.63-8 (Aug. 1983). In Russian.
Concentration dependence of partition coefficients between liquid and gas phases is considered in ideal and nonideal multicomponent systems. The expressions obtained may be used for the headspace analysis of industrial products. (4 refs.)

Gravity-induced density and concentration profiles in binary mixtures near gas-liquid critical lines ....See Entry 119150

Closed-loop phase diagrams, vaporization, and multicriticality in binary liquid mixtures ....See Entry 119157

Application of the NRTL model for calculating phase equilibria in ternary systems with immiscibility gaps ....See Entry 119170

Enthalpy-concentration data for the systems carbon tetrachloride-xylene ....See Entry 119226

Precise vapour-pressure measurements of the solubilization of benzene by aqueous sodium octylsulphate solutions ....See Entry 120681

64.70H Solid-vapour transitions

119167 Effect of UV illumination on the sublimation of basal surfaces of zinc oxide. D.A.Carey (US Air Force Acad., Colorado Springs, CO, USA), R.A.Rapp, J.P.Hirth.
J. Chem. Phys. (USA), vol.79, no.6, p.3160-2 (15 Sept. 1983).
In view of questions about the rate controlling mechanism of ZnO sublimation, experiments were undertaken to determine the effect of photoexcitation on the rate of sublimation. If charge recombination were rate controlling, the increased electronic charge carrier density produced by photoexcitation should increase the rate from both basal surfaces, while this need not be so for the other model. (7 refs.)

119168 Evaporation of metals by a high-energy-density source. D.Havazelet, A.Birnboim (Nuclear Res. Center-Negev, Beer Sheva, Israel).
J. Phys. D (GB), vol.16, no.10, p.1917-28 (14 Oct. 1983).
The authors present a theoretical model describing the evaporation and expansion of vapours from metal surfaces subject to high energy density. The model links the surface temperature of the metal with the evaporation rate and the hydrodynamic parameters of the vapour near the surface. These parameters serve as boundary values for the hydrodynamic equations describing the gas flow, which are solved by a 1-D Lagrangian simulation code. A criterion for the transition from hydrodynamic flow to molecular flow far from the metal is presented, with the aid of which they predict the vapour flux and velocity distribution as a function of the surface temperature. Good agreement between their predictions and empirical results is found. (8 refs.)

Phase composition of vacuum condensates in the Y_2O_3-ZrO_2 system ....See Entry 120315

64.70J Liquid-liquid transitions

119169 Existence of a novel liquid phase in methyl acetate. S.Kawanishi (Takasaki Radiation Chem. Res. Establ., JAERI, Takasaki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3093-100 (Sept. 1983).
For methyl acetate with a planar structure C-CO-O in the molecule, a spin-lattice relaxation time (T_1) and a specific volume were measured in the liquid phase. Methyl acetate has a liquid-liquid phase transition at −12°C at atmospheric pressure. The liquid phase is divided into two parts named as L_1 and L_2 corresponding to high and low temperature liquid phases, respectively. An analysis of the T_1-temperature relation resulted in two kinds of mode of the molecular motion. The phase transition corresponds to the change in the molecular motion and the mode whose correlation time is shorter than the other appears in each liquid phase. The L_2 state is a mesomorphic state due to a planar structure of C-CO-O group. A pressure dependence of the transition temperature was obtained from T_1 measurement at high pressure. The value of dP/dT at 150 MPa is about 5×10^6 Pa/deg.

119170 Application of the NRTL model for calculating phase equilibria in ternary systems with immiscibility gaps. Yu.Schmel'tsev, A.I.Victorov, K.Kvich, N.A.Smirnova.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.46-51 (Aug. 1983). In Russian.
The results of liquid-liquid and liquid-liquid-vapour equilibria calculations using the NRTL model are presented for 21 ternary systems. Predictions of phase equilibria and correlations of experimental ternary solubility data are made. (7 refs.)

Ultrasonic study of critical behavior in the binary liquid 3-methylpentane+nitroethane ....See Entry 119105

Critical ultrasonic attenuation in the binary liquid cyclohexane+nitroethane ....See Entry 119106

Active-coupling mixing times for a stirred binary liquid ....See Entry 119209

64.70K Solid-solid transitions

(see also 61.50K Crystallographic aspects of polymorphic and order-disorder transformations, 81.30H, 81.30K, 81.30M Microstructures developed by solid-solid phase transformations)

119171 Polymorphic transformations of rare-earth oxides under shock stress. V.N.German, A.M.Podurets, L.A.Tarasova.
Inorg. Mater. (USA), vol.18, no.10, p.1492-4 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1736-8 (Oct. 1982). [received: Sept. 1983]
The rare-earth oxides Sm_2O_3, Er_2O_3, Dy_2O_3, Yb_2O_3, and Y_2O_3 transform from the cubic C phase to a monoclinic B phase after shock compression to pressures of 12-35 GPa. The transformation may be produced by a decrease in the interionic separation in the lattice and electron rearrangement in the metal atoms as a result of the high pressure. (11 refs.)

119172 Structural phase transition in the Chevrel-phase $Ag_{1.6}Mo_6S_8$. Zong-Hao Lee, K.Noto, Y.Muto (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.2966-9 (Sept. 1983).
An order-disorder phase transition was found in Chevrel-phase $Ag_{1.6}Mo_6S_8$ at about 280K. From a comparison of results of the electrical resistance and the X-ray diffraction to those in $Cu_{1.8}Mo_6S_8$, this is thought to be a structural phase transition from rhombohedral to triclinic due to the order-disorder transition of Ag atoms. (6 refs.)

119173 X-ray study of phase transition in $NaClO_4$. S.Yamamoto, Y.Shinnaka (Dept. of Phys., Yamaguchi Univ., Yamaguchi, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3080-4 (Sept. 1983).
The phase transition in $NaClO_4$ from the NaCl-type cubic phase (O_h^5) to the orthorhombic phase (D_{2h}^{17}) is investigated with the X-ray diffraction method. In the cubic phase, X-ray diffuse maxima are observed at the *X*-points of the Brillouin-zone boundary. The intensity of the diffuse maximum anomalously increases with decreasing temperature toward the transition point. In the orthorhombic phase, the intensity of the superlattice reflection sharply decreases near the transition point and the lattice constant *b* shows anomalous expansion with increasing temperature. It is suggested that a coupling between multi-orientation of the ClO_4^- ion and phonons plays an important role in the phase transition.

119174 Successive phase transitions in Cs_2CdBr. M.Maeda, A.Honda, N.Yamada (Dept. of Appl. Phys., Tohoku Univ., Sendai, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3219-24 (Sept. 1983).
X-ray and dielectric measurements were made on Cs_2CdBr_4 (CCB) crystals, and optical observation was also made. CCB undergoes successive phase transitions at $T_1=-21°C$, $T_2=-36°C$ and $T_3=-65°C$. The space groups in all phases have been determined: I: Pnam, II: $P_{\bar{1}ss}^{Pnam}$, III: $P2_1/n$ and IV: $P\bar{1}$. The space group for the incommensurate II-phase is determined on the basis of a four-dimensional space group concept. Temperature dependence of the position and the intensity of satellite reflections in the incommensurate phase was measured. Rotation of optical indicatrix was found in III- and IV-phases and its temperature dependence was measured. Ferroelastic activities in III- and IV-phases were found.

119175 Optically detected low temperature phase in pyrene crystals. K.Mizuno, A.Matsui (Dept. of Phys., Konan Univ., Kobe, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3260-4 (Sept. 1983).
Absorption and luminescence spectra in pyrene have been investigated. Absorption spectra below the phase transition point at 120K exhibit structures which are not observed in the room temperature spectra. Below the phase transition temperature another dimeric phase (α') which differs from that in the room temperature phase (α) is suggested to appear. This suggestion is consistent with information reported from the electron diffraction patterns. The relationship between the specimen cooling method and the occurrence of the phase transition is briefly discussed.

119176 Temperature dependence of the wave vector of the incommensurate modulation in two $BaMnF_4$ crystals grown by different techniques; neutron and X-ray measurements. M.Barthes-Regis, R.Almairac, P.St-Gregoire (CNRS, Univ. des Sci. et Tech. du Languedec., Montpellier, France), C.Filippini, U.Steigenberger, J.Nouet, Y.Gesland.
J. Phys. Lett. (France), vol.44, no.19, p.L829-35 (1 Oct. 1983).
Neutron elastic scattering measurements on two incommensurate $BaMnF_4$ crystals show that the incommensurability δ is temperature dependent. The large observed 'global' hysteresis and the sample dependent residual value of the incommensurability at low temperature indicate the importance of lattice defects. A very small angular lattice distortion has been observed below $T_0\simeq250K$ by means of X-ray measurements of the width of some Bragg spots. This observation is in agreement with the theory of the structural

transition in $BaMnF_4$ which predicts the possibility of a ferroelastic strain below $T<T_0$. (12 refs.)

119177 **Studies of structural transitions in TMA-TCNQ-I by high voltage electron diffraction.** T.Granier, R.Ayroles (Lab. d'Optique Electronique, CNRS, Toulouse, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1301-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
By using high accelerating voltage and electron diffraction, the authors show that the trimethylammonium-iodide-tetracyanoquinodimethane or $TMA^+(TCNQ)^{2/3-}(I_3^-)_{1/3}$, having a monoclinic symmetry, exhibit structural transitions at low temperatures: 150K, 90K and 65K. From their studies of electron irradiation effects, they have determined the best conditions for the observation of charge density waves in organic crystals: high voltage and low temperature. (19 refs.)

119178 **Landau theory of pressure induced phase transitions in TTF-TCNQ.** S.Megtert (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France), A.Bjelis, J.Przystawa, S.Barisic.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1345-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Transport and structural measurements on TTF-TCNQ under high pressure have revealed a very complex phase diagram. The analysis of the symmetry properties of various displacive modes coupled to the conduction electrons shows that the essential features of this phase diagram can be described with a two-chain model in the framework of the Landau theory. (4 refs.)

119179 **Structural phase transition of $CsPbCl_3$ below room temperature.** M.Hidaka (Dept. of Phys., Kyushu Univ., Fukuoka, Japan), Y.Okamoto, Y.Zikumaru.
Phys. Status Solidi a (Germany), vol.79, no.1, p.263-9 (Sept. 1983).
Studies of the structural phase transition of $CsPbCl_3$ are carried out, using X-ray and neutron diffraction, NQR, and Raman scattering below room temperature. It is confirmed that there is a second-order transition at about 200K (T_{c4}). From the structural analysis, it is determined that, at room temperature, the structure has an orthorhombic symmetry $D_{2h}{}^{16}$-Pbnm, and, below T_{c4}, it has a monoclinic symmetry $C_{2h}{}^5$-$P2_1/c$. The transition at T_{c4} is not associated with the condensation of rotational modes of $PbCl_6$ octahedra around any principal axes, but associated with the elastic soft mode. (15 refs.)

119180 **Mechanism of solid state transformations in single crystals of $Zn_xCd_{1-x}S$.** M.T.Sebastian, P.Krishna (Dept. of Phys., Banaras Hindu Univ., Varanasi, India).
Phys. Status Solidi a (Germany), vol.79, no.1, p.271-80 (Sept. 1983).
The mechanism of solid state transformations in single crystals of $Zn_xCd_{1-x}S$ is investigated by annealing metastable 2H crystals at different temperatures, arresting the solid state transformation by quenching in cold water, and examining the structure of the intermediate state by X-ray diffraction. In the range $x=0.93$ to 0.95, the 2H structure is found to transform a disordered 6H structure at temperatures around 600°C. This 6H structure does not transform further to the 3C structure on annealing at higher temperatures. It is observed that the mechanism of the 2H to 6H transformation in these crystals is very different from that proposed by Pandey, Lele, and Krisha (1980) for a similar transformation in SiC. A model of transformation involving the nonrandom insertion of stacking faults is developed using a fault probability α for random nucleation of the 6H phase and a fault probability β for the growth of the 6H nuclei. The diffraction effects calculated from such a model for both, deformation faults and layer-displacement faults are compared with those recorded on a single crystal diffractometer using partially transformed crystals. It is concluded that the model of transformation by a nonrandom insertion of deformation faults with $\beta \gg \alpha$, closely approximates the actual mode of transformation in these crystals. (11 refs.)

119181 **Study of the 25K NpO_2 phase transition by a neutron oscillation camera.** A.Boeuf, R.Caciuffo (Inst. Laue-Langevin, Grenoble, France), J.M.Fournier, L.Manes, J.Rebizant, F.Rustichelli, J.C.Spirlet, A.Wright.
Phys. Status Solidi a (Germany), vol.79, no.1, p.K1-3 (Sept. 1983).
The existence of a phase transition in NpO_2 below 25K was deduced from measurements of macroscopic physical quantities but no evidence based on observations of microscopic quantities has till now confirmed the presence of this phase transition. (8 refs.)

119182 **Theory of the structural phase transition in A15 compounds.** M.Kataoka (Res. Inst. for Iron, Steel and Other Metals, Tohoku Univ., Sendai, Japan).
Phys. Rev. B (USA), vol.28, no.5, p.2800-15 (1 Sept. 1983).
The structural phase transition in the *A*15 compounds are investigated theoretically with the standpoint that the band Jahn-Teller effect of the two-fold-degenerate Γ_{12} subbands crossing the Fermi level is responsible for the instability. On the basis of $\vec{k}.\vec{p}$ perturbation theory, the Γ_{12} subbands are revealed to be well described by two parabolic bands which couple not only to the bulk distortions, but also to the displacements of the Γ_{12} optic modes. It is found that when the electron-lattice coupling exceeds the threshold of strength, the tetragonal phase with almost the same stabilities of $c/a>1$ and $c/a<1$ appears, accompanying one of the Γ_{12} optic modes below a weak first-order phase transition temperature T_M. The temperature dependences of the elastic moduli are calculated; it is found that c_{11}-c_{12} vanishes below T_M while c_{33}-c_{13} recovers from its softening partially or completely with decreasing temperature below T_M while c_{33}-c_{13} recovers from its softening partially or completely with decreasing temperature below T_M. The long-wavelength acoustic phonons are also investigated in order to clarify the relation between the phonon anomalies and the structural transition. The $[110]T_1$ mode $(\vec{q}\,\|\,[110],\ \vec{e}\,\|\,[1\bar{1}0])$ is considerably softened in the range $0<q\lesssim 2k_F$. This softening begins at high temperatures, remaining even at absolute zero. The theory explains successfully the various aspects of the phase transitions in V_3Si and Nb_3Sn. The comparison between them proves that the second-order Jahn-Teller effect occurs in both compounds. (51 refs.)

119183 **Pressure-induced phase transition in β-$LiIO_3$.** V.Lemos, J.M.Filho, F.E.A.Melo, R.S.Katiyar, F.Cerdeira (Inst. de Fisica 'Gleb Wataghin', Univ. Estadual de Campinas, Sao Paulo, Brazil).
Phys. Rev. B (USA), vol.28, no.6, p.2985-9 (15 Sept. 1983).
The authors report the first observation of a pressure-induced phase transition in $LiIO_3$. A new phase appears when β-$LiIO_3$ is compressed hydrostatically at room temperature, beyond 50 kbar. This is a reversible first-order transition with negligible hysteresis. The new phase (δ-$LiIO_3$) cannot be obtained by heating or cooling either α- or β-$LiIO_3$ or by compressing the former. They observe the transition by studying the evolution of the Raman spectrum of β-$LiIO_3$ as a function of pressure (1 bar-95 kbar). They also report a detailed study of the pressure dependence of Raman frequencies for β-LiO_3. The regularities observed in the mode-Gruneisen parameters and other pressure coefficients for the β phase give insight into the probable structure of the high-pressure phase. (17 refs.)

119184 **High-pressure X-ray diffraction studies on HgTe and HgS to 20 GPa.** A.Werner, H.D.Hochheimer, K.Strossner (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany), A.Jayarman.
Phys. Rev. B (USA), vol.28, no.6, p.3330-4 (15 Sept. 1983).
HgTe and HgS have been investigated with the use of the high-pressure X-ray diffraction technique to 20 GPa. HgTe undergoes three pressure-induced phase transitions in the (0-20)-GPa range, from zinc blende to cinnabar to rocksalt to β-Sn, at 1.4, 8, and 12 GPa, respectively. HgS does not show any evidence for a transition from the cinnabar structure up to 20 GPa, either in high-pressure X-ray diffraction or in high-pressure Raman studies. The above transition sequence agrees with the pressure-induced sequence for CdTe except for the intrusion of a cinnabar structure. Evaluation of the bulk modulus B_0 and B'_0 are 19.4 ± 0.5 GPa, and 11.1 for HgS, and 16.0 ± 0.5 GPa and 7.3 for HgTe. Bulk moduli, volume changes for transitions, and lattice parameters of the high-pressure phases have all been determined from the X-ray data. The observed transition sequence for HgTe appears to be in agreement with the predictions of recent pseudopotential total-energy calculations for phase stability in III-V and II-VI compounds under pressure. (18 refs.)

119185 **Neutron powder diffraction study of phase transitions and structures of $(KCN)_x(KBr)_{1-x}$ mixed crystals.** J.M.Rowe, J.J.Rush (Nat. Measurement Lab., NBS, Washington, DC, USA), S.Susman.
Phys. Rev. B (USA), vol.28, no.6, p.3506-11 (15 Sept. 1983).
The structures of $(KCN)_x(KBr)_{1-x}$ mixed crystals for $x=0.95$, 0.90, and 0.80 have been determined as a function of temperature. As the temperature is decreased from 295K, where all of the samples are cubic (as are pure KCN and KBr), all samples measured transform to a monoclinic structure (space group C_c). For $x=0.95$ and 0.90, at a lower temperature there is a further transition to an orthorhombic structure similar to that found for pure KCN below 168K. However, the samples do not transform completely, and the monoclinic and orthorhombic structures coexist down to 6K. More of the sample transforms for $x=0.95$ than for $x=0.90$. In both cases, that part of the sample which goes into the orthorhombic phase orders completely at the lowest temperatures, in a structure similar to that found for pure KCN at 6K. (15 refs.)

119186 **Phase transition in cadmium chlorapatite $[Cd_5(PO_4)_3Cl]$.** Hong Lee Park, Min Soo Jang (Dept. of Phys., Busan Nat. Univ., Busan, Korea).
Solid State Commun. (USA), vol.48, no.2, p.109-10 (Oct. 1983).
The phase transition in cadmium chlorapatite from $P6_3/m$ ($C_{6h}{}^2$) to $P6_3/mcm$ ($D_{6h}{}^3$) has been confirmed through the temperature dependent Raman measurements. The phase transition temperature (T_c) from lower temperature phase ($P6_3/m$) to high temperature phase ($P6_3/mcm$) is approximately 700°C and is detected through the disappearing of LT phase A_g Raman bands as the temperature approaches to T_c. (3 refs.)

119187 **Hydrate to pseudohydrate transformation in $Cd(ClO_4)_2.6H_2O$: An IR study.** M.B.Patel, H.D.Bist (Dept. of Phys., Indian Inst. of Technol., Kanpur, India).
Solid State Commun. (USA), vol.48, no.2, p.139-41 (Oct. 1983).
The modes of water in $Cd(ClO_4)_2.6H_2O$ exhibit a sharp discontinuity at 248 ± 1K. The appearance of new bands attributable to the OH^- and H_3O^+ ions below 248K indicates the transformation of the normal hydrate to a pseudohydrate. A strong Fermi resonance is observed between ν_1 and $2\nu_4$ bands of H_3O^+. (12 refs.)

119188 **Magnetic, elastic, and thermal properties of Rb_2NaHoF_6.** R.Sh.Zhdanov, F.L.Aukhadeev, A.B.Liberman, N.I.Silkin, M.A.Teplov, Sh.I.Yagudin, M.Sh.Yagfarov (V.I. Ulyanov-Lenin State Univ., Kazan, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.535-6 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.929-31 (March 1983). [received: Oct. 1983]
Holmium hexafluoride Rb_2NaHoF_6 has the cubic structure of elpasolite (complex perovskite) at room temperature. Crystals with this structure exhibit ferroelectric phase transitions. The authors report evidence of a domain structure in this crystal at low temperatures and of a structural transition at $T_c=167\pm2$K. (5 refs.)

119189 **Computation of phase transformations in heterogeneous solids.** H.Dohler, H.Strobel (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.139-46 (1983). In German.
Numerical examples are calculated for different types of processes of exchange of particles within a 2-box-model, distinguished in Z. Phys. Chemei 261 (1980) 876. Thier evaluation renders it possible to investigate the differential equations of the model qualitatively. The solutions may serve for mathematical modelling the dependence of time of phase transformations accompanied by exchange of matter. This may be applied to a system of thin films, or to a heterogeneous medium made up of a mixture of grains occurring in two different phases, or of a solid with growing nuclei included (sintering, Otswald-type ripening martensitic transformations). No use of the assumption of local thermodynamic equilibrium within the phase boundary regime has to be made. Processes controlled by reactions at the interfaces are admitted. (9 refs.)

On interaction of thermo-acoustic waves with the progress of phase transition: a continuum approach. II. Growth and decay of thermo-acoustic waves .... See Entry 118484

Anion ordering in $(TMTTF)_2ReO_4$: a displacive transition ..... See Entry 118945

Polymorphic phase transitions in alkali cyanide crystals .... See Entry 118946

X-ray diffraction study of californium metal to 16 GPa .... See Entry 118959

Crystal data for two orthophosphates: α-$NaCuPO_4$ and β-$AgCuPO_4$ .... See Entry 118969

Synchrotron X-ray diffraction study of the room temperature incommensurate phase in graphite-bromine intercalation compound .... See Entry 118981

Neutron-diffraction study of polycrystalline H_2SO_4 and H_2SeO_4 .... See Entry 118986

$(TMTSF)_2ClO_4$: mean structure at 7K. Comparative study with 300K and 125K data .... See Entry 118993

Radical cation salts of arenes, synthesis, structures and properties .... See Entry 118995

Diffuse X-ray scattering and order-disorder effects in the iodide chain compound 4-(2,6-diphenyl, 4-H-thiopyran-4-ylidene)-2,6-diphenyl iodide, $DIPS\Phi_4(I_3)_{0.76}$ .... See Entry 119000

Anisotropic elastic limits and phase transitions of rutile phase TiO_2 under shock compression .... See Entry 119102

On interaction of thermo-acoustic waves with the process of phase transition: a continuous approach. I. Constitutive equations and propagation velocities .... See Entry 119114

Quantum and thermal nucleation in polydiacetylene .... See Entry 119151

Phase diagrams of surface structures from Bethe-ansatz solutions of the quantum sine-Gordon model .... See Entry 119158

Transitions and relaxations in mesophase polymers: thermotropic liquid crystalline polyesters with mesogenic groups in the main chain .... See Entry 119194

Thermal expansivity of α-$LiIO_3$ between 20 and 520K .... See Entry 119234

Thermal expansion and isothermal compressibility of thallium telluride .... See Entry 119238

Thermal conductivity of lead sulfide-based solid solutions .... See Entry 119285

Alkali metal-induced reconstruction of Ag(110) .... See Entry 119322

Heat capacity of diatomic molecules adsorbed on a periodic substrate and the localized-to-mobile transition .... See Entry 119340

Phase transitions in monolayers adsorbed on uniaxial substrates .... See Entry 119343

Theory of anion ordering in TMTSF compounds .... See Entry 119438

Stacking of charge-density waves in 1*T* transition-metal dichalcogenides .... See Entry 119486

Structural properties of III-V zinc-blende semiconductors under pressure .... See Entry 119494

Phase transition description down to 10K in the first ternary 1D organic conductor: $TMA^+TCNQ^{2/3-}$ $(I_3^-)^{1/3}$ .... See Entry 119573

Physical properties of the TMTTF salts and TMTSF/TMTTF alloys: competition between the stacks instabilities .... See Entry 119810

Magnetic study of the phase transitions in $(TMTTF)_2X$ salts .... See Entry 119839

Optical phenomena in $BaMnF_4$ near its phase-transition temperatures .... See Entry 120008

High-pressure optical absorption and X-ray-diffraction studies in RbI and KI approaching the metallization transition .... See Entry 120021

Luminescence of high pressure phases of Eu^{2+}-activated alkaline earth borates and silicates .... See Entry 120135

Trap-level spectroscopy using the 'nonequilibrium-phase-transition model' of thermally stimulated luminescence .... See Entry 120166

Solidification and solid state transformations during cooling of chromium-molybdenum white cast irons .... See Entry 120321

Phase transitions and thermoluminescence of a plasma-sprayed zinc silicate phosphor .... See Entry 120326

Kinetics of Austenite-pearlite transformation in eutectoid carbon steel .... See Entry 120327

Single crystal neutron diffraction study of the long-range order in Cu_2NiZn .... See Entry 120328

On the effect of fine grain size on the M_s temperature in Fe-27Ni-0.025C alloys .... See Entry 120329

Can inherited textures in the BCC phase furnish information about the type of transformation from the FCC phase? .... See Entry 120350

Diffraction-contrast study of microstructure and deformation process of WC-Co cemented carbide .... See Entry 120370

Microstructure and mechanical properties of Zn-Al alloys at room temperature .... See Entry 120379

On the high-energy product Fe-Pt permanent magnet alloys .... See Entry 120455

The α-β transition of quartz; a view of some current problems: order-disorder or displacive transition, thermodynamic behaviour .... See Entry 121212

64.70M Transitions in liquid crystals

119190 The nematic elastic constants from the Ginzberg-Landau Hamiltonian of the nematic to isotropic phase transition. K.Rosciszewski (Inst. of Phys., Jagellonian Univ., Cracow, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.3, p.277-83 (Sept. 1983).
The nematic elastic constants are obtained from the Ginzburg-Landau Hamiltonian (of the nematic is isotropic phase transition) with two order parameters. The first order parameter is the well known symmetric traceless second rank tensor and the second one is a fourth rank tensor. (10 refs.)

119191 Phase transition of nematic polymers in elongational flow. P.Maissa, A.Ten Bosch, P.Sixon (Lab. de Phys. de la Matiera Condensee, CNRS, Nice, France).
J. Polym. Sci. Polym. Lett. Ed. (USA), vol.21, no.9, p.757-65 (Sept. 1983).
The purpose of the article is to investigate the effect of elongational flow within the mode of elastic wormlike chains used previously to calculate the phase transition of semirigid polymers (Ten Bosch et al. 1980). (41 refs.)

119192 Pressure studies of liquid crystalline transitions. R.Shashidhar (Raman Res. Inst., Bangalore, India).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.13-30 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Some of the important results emerging from recent pressure studies of liquid crystalline transitions are presented. In particular, the following topics are discussed: (i) The relation between P_m, the maximum pressure of smectic stability in reentrant mesogens, and the range of the nematic phase at atmosphere pressure vis-a-vis the molecular structure; (ii) Piezothermal studies in the vicinity of the A-N transition in 8 OCB; (iii) The influence of molecular ordering on the pressure behavior of the nematic-isotropic transition in reentrant nematic mixtures; and, (iv) The relation between the pressure behavior of the smectic A phase and the interdigitation of the molecules. (38 refs.)

119193 Smectic C-nematic transition in the mixtures 5_x6_{1-x}BABA. K.Usha Deniz, P.S.Parvathanathan, J.V.Yakhmi, A.V.Patankar (Bhabha Atomic Res. Centre, Bombay, India).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.83-9 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Describes DSC investigations of the (S_c-N) transition in the mixtures 5_x6_{1-x}BABA, for $0 \leq x < 1$. This transition could only be observed for $x \leq 0.8$. A marked difference was found in the chain length dependences of both the transition temperature, T_{CN}, and the transition entropy, ΔS_{CN}, between the pure and mixed compounds. This might be ralated to the difference between end hydrocarbon chain conformations of 5BABA and 6BABA. Specific heat measurements show (i) for $x=0$, a first order transition with hardly any fluctuations, (ii) for $x=0.59$, an almost continuous transition, but again with weak fluctuations. The fact that the fluctuations remain weak near T_{CN} even when ΔS_{CN} is very small, is attributed to large bare coherence lengths. (11 refs.)

119194 Transitions and relaxations in mesophase polymers: thermotropic liquid crystalline polyesters with mesogenic groups in the main chain. V.Frosini, S.de Petris (Dept. of Chem. Engng., Univ. of Pisa, Pisa, Italy), E.Chiellini, G.Galli, R.W.Lenz.
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.223-42 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The thermal and dynamic viscoelastic behavior of some thermotropic liquid crystalline polyesters based on α, ω-bis(4-hydroxybenzoyloxy)alkanes, and terephthalic acid is reported. Original samples obtained by solution polymerization followed by precipitation showed physical and dynamic-mechanical properties typical of semicrystalline polymers. Quenching of the polymers from the LC state gave rise to glass-like mesomorphic modifications that retained a glass transition at considerably higher temperature T_{gm} than that of the corresponding amorphous material T_{ga}. However, the formation of a new crystal form with respect to the original sample could not be prevented and the polymers so obtained were in fact partially mesomorphic and partially crystalline materials. All the quenched samples exhibited by dynamic-mechanical and calorimetric analyses a first order solid-solid transition independent of the length of the flexible spacer. Such a phenomenon was interpreted as an order-disorder transition of the material quenched from the LC state. (13 refs.)

Phase diagram of a spin-1 quantum Ising model with dipole and quadrupole interactions .... See Entry 117109

The first bilayer ferroelectric liquid crystal .... See Entry 118866

The cholesteric blue phase: a progress report .... See Entry 118870

McMillan theory of binary smectic mixtures .... See Entry 118876

Novel liquid crystalline derivatives of cubanes and hydrogenolyzed cubanes .... See Entry 118881

Thermotropic homopolyesters. Investigation of the smectic phase of polyesters based on *p,p'*-bibenzoic acid .... See Entry 118887

Dynamic light scattering of surface fluctuations of a nematic liquid crystal .... See Entry 119312

The effect of substituents at benzoic ring on the parameters of cholesteryl benzoates infrared spectra in phase transitions .... See Entry 120077

64.70P Glass transitions

119195 Homogeneous equilibria in liquid alloys and glass formation. F.Sommer (Max-Planck-Inst. fur Metallforschung, Inst. fur Werkstoffwissenschaften, Stuttgart, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.749-56 (Sept. 1983).
Using homogeneous equilibria reactions for the description of chemical short range order tendencies in liquid alloys with compound forming tendency it is possible, using the association model, to describe different kinds of asymmetrical concentration dependences, to calculate the temperature dependences of the thermodynamic mixing functions as well as to extrapolate for multicomponent systems. The existence of chemical short range order is an important factor of influence on the glass forming ability obtained by rapid quenching from the liquid phase. On the one hand, it causes small chemical driving forces for crystallization and, thereby, thermodynamic promotion of glass formation. On the other hand, glass formation is additionally kinetically favoured if the stoichiometric compositions of the associates in the liquid alloys are not in accordance with those of the crystalline equilibrium phases in the glass formation range. (32 refs.)

119196 Effect of copolymerization on the glass transition temperature of PAN. N.Chand (Chem. Engng. Div., Nat. Chem. Lab., Pune, India).
Indian J. Technol., vol.21, no.3, p.126-7 (March 1983). [received: Oct. 1983]
Two copolymers of different compositions of PAN and HEMA have been prepared and their glass transition temperatures determined by a dielectric technique. The effect of copolymerization on the structure of PAN has also been discussed. (4 refs.)

119197 Properties of glasses in the system AgI-Ag_2O-B_2O_3. G.H.Frischat, S.Speyer, W.Wegener (Inst. fur Nichtmetallische Werkstoffe, Tech. Univ. Clausthal, Gottingen-Clausthal, Germany).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.122-3 (Aug. 1983).
Glasses with AgI contents between 75 and 50 mol.% were prepared in the pseudo binary system AgI-Ag_2O-B_2O_3 by different methods and at varied cooling rates. Glass transition temperatures, densities, and thermal expansion coefficients were measured and compared with literature data. Thermal history markedly influences the properties. (9 refs.)

119198 Effect of vitrification pressure on radius of gyration, specific heat and density of amorphous polymers. J.M.O'Reilly (Res. Labs., Eastman Kodak Co., Rochester, NY, USA), R.S.Stein, G.Hadziioannou, G.D.Wignall.
Polymer (GB), vol.24, no.10, p.1255-8 (Oct. 1983).
The effects of vitrification pressure (to 500 MPa) and temperature (to 180°C) on the radius of gyration (as determined by small-angle neutron scattering), specific heat and density were measured for polystyrene and poly(methyl methacrylate). The radius of gyration increased slightly (5×10^{-3}/°C) in both polymers; this increase is near the experimental uncertainty in the measurements. The small observed values are due to either small intrinsic effects of temperature or pressure on the conformation or competing effects of temperature and pressure. Density and specific heat showed changes which have been observed before and are attributed to intermolecular factors. (12 refs.)

Composition of phosphosilicate glass films obtained by hydrolysis of tetraethoxysilane solutions .... See Entry 118896

Properties and structure of glasses in the system $10K_2O{\cdot}20Ba0{\cdot}70(SiO_2, GeO_2, B_2O_3)$ .... See Entry 118897

Structure and morphology of segmented polyurethanes. I. Influence of incompatibility on hard-segment sequence length .... See Entry 118919

Characteristics of the crystals of derivatives of $12CaO.7Al_2O_3$ .... See Entry 118949

Dependence of the specific volume of the bisphenol-A polycarbonate on its molecular characteristics .... See Entry 119084

Transitions and relaxations in mesophase polymers: thermotropic liquid crystalline polyesters with mesogenic groups in the main chain .... See Entry 119194

Electrical, optical and glass transformation properties of amorphous solids—a review .... See Entry 119543

The effect of physical ageing on the properties of poly(ethylene terephthalate) .... See Entry 120381

High-temperature thermoviscoelasticity of drawn poly(ethylene terephthalate) ....See Entry 120392

Correlations of the dry crazing resistance of glassy polymers with other physical properties ....See Entry 120460

64.75 SOLUBILITY, SEGREGATION, AND MIXING

119199 The enthalpy effect on forming diluted solid solutions of two 4d and 5d transition metals. A.K.Niessen, A.R.Miedema (Philips Res. Labs., Eindhoven, Netherlands).

Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.717-25 (Sept. 1983).

Predictions of the enthalpies of solution in the solid state will be presented for arbitrary combinations of 4d and 5d transition metals. In addition to the contribution stemming from the chemical interaction, which is equal to the enthalpy of solution in the liquid state, the enthalpy of solution in the solid state contains two other terms. The first of these accounts for the elastic energy arising from the atomic size mismatch, where this size mismatch has been corrected for volume changes that accompany the alloy formation. The second term takes into account the variation of the structure dependent energy in relation to the number of d-electrons per atom. The predictions are generally in good agreement with the solubilities found in the respective phase diagrams. For two systems, Zr in Pt and Pt in Nb, that on first sight present exceptions, preliminary experiments indicate that parts of the respective phase diagrams have to be revised. The structure-dependent contribution manifests itself not only in the limiting solubilities in the main crystal structures of the pure metals but also in the existence of disordered intermediate phases and may also be responsible for the anomalously large entropy of fusion recently observed for some transition metals. (18 refs.)

119200 Calorimetric investigations of liquid alkaline earth metal alloys. F.Sommer, J.J.Lee, B.Predel (Inst. fur Metallkunde, Univ. Stuttgart, Stuttgart, Germany).

Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.792-7 (Sept. 1983).

The concentration dependences of the enthalpy of mixing of liquid copper-magnesium and calcium-copper alloys have been determined, applying direct mixing calorimetry, in the temperature range between 1120 and 1125K. The enthalpies of mixing are discussed in connection with known thermodynamic quantities and the asymmetrical concentration course obtained can be described by an association model. Systematic comparison is carried out between the experimentally obtained enthalpies of mixing—together with other recent experimental data—and those obtained according to the Miedema model (1980). The concentration dependence used in the model is not able to describe the results of alloy melts with strong compound formation tendency. The enthalpy of mixing can be calculated in nearly 40% of the systems investigated with less than 30% error and in 64% with an error less than 2.5 kJ mol^{-1}. (40 refs.)

119201 The use of lattice theory in the calculation of excess properties of fluid mixtures. VI. Prediction of Gibbs' free energies and enthalpies of mixing of binary systems using model by Tompa. K.Suhnel (Sektion Chem., Karl-Marx-Univ. Leipzig, Leipzig, Germany).

Chem. Tech. (Germany), vol.35, no.9, p.469-74 (Sept. 1983). In German.

The applicability of the lattice model by Tompa (1953) was investigated for the prediction of vapour-liquid equilibria and enthalpies of mixing of binary nonelectrolyte systems with different polar components. The prediction of VLE and H^E was difficult for mixtures containing two components with either very little difference in polarity or with considerable differences in their molar volumes. The precalculation of thermodynamic mixing properties of all other systems was possible with two constant parameters and a third parameter depending linearly on the chain length of n-paraffins. The deviation between experimental and predicted properties were compared with those given by UNIFAC or with those obtained using a predictive Barker (1952) model. (135 refs.)

119202 Solution of the coalescence kinetics problem after Ostwald. R.D.Vengrenovich.

Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.27-32 (1983). In Ukrainian.

A new method is suggested to solve the initial system of differential equations which determine coalescence kinetics after Ostwald. The effect of the matrix crystal structure on the particle size distribution function is taken into account. (12 refs.)

119203 LCST behaviour in blends of PMMA with PVC. H.Jager, E.J.Vorenkamp, G.Challa (Lab. of Polymer Chem., State Univ. of Groningen, Groningen, Netherlands).

Polym. Commun. (GB), vol.24, no.10, p.290-2 (Oct. 1983).

It is difficult to draw conclusions about the compatibility of polymer blends, when a lower critical solution temperature (LCST) is situated at a temperature where diffusion of the polymer chains is strongly hindered by the high viscosity of the blend. This is demonstrated on the system at PMMA/PVC, which showed, compatibility at all compositions only when prepared at low temperatures from mixed solutions. Heating to high temperature causes demixing, not followed by remixing after cooling, because of kinetic reasons. In reducing the molar mass of one or both polymer samples, the viscosity of the blend decreased and the LCST increased, which made it possible to observe an equilibrium LCST behaviour of this blend. (10 refs.)

119204 Study of the system $NH_4Fe(SO_4)_2$-H_2SO_4-H_2O or 25°C and the appearance of solid phases. L.Kristanova, T.Tomov (Forschungslab. fur anorganische Salze, Bulgarischen Akad. der Wissenschaften, Sofia, Bulgaria).

Izv. Khim. Bulg. Akad. Nauk. (Bulgaria), vol.15, no.4, p.508-18 (1982). In German. [received: Sept. 1983]

The solubility at 25°C of the $NH_4Fe(SO_4)_2$-H_2SO_4-H_2O system was investigated and the fields of crystallization outlined. There are fields of $NH_4Fe(SO_4)_2 12H_2O$ and $NH_4Fe(SO_4)_2.3H_2O$ in the system. It was found that on dehydration the ammonium ferric alum changes into the stable $NH_4Fe(SO_4)_3.3H_2O$. The trihydrate is stable up to a definite concentration of sulphuric acid. At higher acid concentrations it decomposes affording $Fe_2(SO_4)_3.H_2SO_4.8H_2O$ as solid phase. The solid phases were investigated by X-ray diffraction, DTA, infrared and Mossbauer spectra. (20 refs.)

119205 Excess properties of binary solvent mixtures containing bromobenzene. T.M.Aminabhavi, E.S.Jayadevappa, B.R.Prasad (Dept. of Chem., Karnatak Univ., Dharwad, India).

Indian J. Chem. A, vol.22A, no.3, p.227-8 (March 1983). [received: Oct. 1983]

Excess polarisabilities and excess volumes of mixing have been measured at 20°C for four binary systems of bromobenzene with benzene, cyclohexane, ethyl acetate and carbon tetrachloride as a function of composition of the mixture. Bromobenzene-carbon tetrachloride system has the largest value for excess polarisability of mixing, while its excess volume is the lowest as compared to the other systems. The Lorentz-Lorenz mixing rule seems to be the best among the existing mixing rules for explaining the present data. (5 refs.)

119206 Enthalpy coefficients of pairwise interactions between polar molecules and long-chain aliphatic ions in water at 298.15K. R.Bury, A.Mayaffre, C.Treiner (Lab. d'Electrochimie, Univ. Pierre et Marie Curie, Paris, France).

J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.10, p.2517-28 (Oct. 1983).

The enthalpy of dissolution of trimethyldecylammonium bromide has been determined in the water-rich region of binary mixtures with dimethylsulphoxide, *N*-methylpyrrolidone, *NN*-dimethylformamide, propan-1-ol, urea and acetonitrile. Some additional measurements are also presented for tetrabutylammonium bromide in some of these binary solvent mixtures. From these data the enthalpy coefficient of pairwise interaction h_{NE} has been calculated. A discussion is presented on the enthalpy of pairwise interaction of aliphatic ions with 12 polar molecules in water. Using the scaled particle theory, the cavity contribution to the h_{NE} values is calculated and shown to be large in comparison with the interaction contribution in all cases except alcohols and acetonitrile. From a comparison of h_{NE} values for the long chain surfactant and for the bulky tetrabutylammonium ion, two different classes of organic molecules emerge: (1) acetonitrile, acetone, 2-methylpropan-2-ol and propan-1-ol and (2) the other polar molecules studied, which include sulpholane, propylene carbonate, dioxane and ethylene glycol. Class (1) decrease the critical micelle concentration of surfactants in water through partitioning between water and the pseudo-micellar phase; class (2) increase the critical micelle concentration and do not interact with the micelles. Thus the behaviour of molecules at post-micellar concentrations may be deduced from information on the thermodynamics of pre-micellar solutions. (35 refs.)

119207 Thermodynamics of liquid mixtures of nitrous oxide and ethene. L.O.Lobo, L.A.K.Staveley (Inorganic Chem. Lab., Oxford Univ., Oxford, England), P.Clancy, K.E.Gubbins, R.S.Machado.

J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1399-415 (Sept. 1983).

Experimental determinations of the vapour pressures, molar volumes and heats of mixing are reported for liquid mixtures of ethene and nitrous oxide at temperatures close to the triple-point temperature of nitrous oxide (182.32K). From these measurements the excess volume, Gibbs free energy and enthalpy are derived. The excess Gibbs energy and the excess enthalpy are found to be positive, almost symmetric functions of composition, with values at the equimolar composition of 168.9 J mol^{-1} and 270.9 J mol^{-1}, respectively. The excess volume, on the other hand, is found to be negative and displays a highly skewed composition dependence, the minimum occurring at $x(N_2O) \approx 0.96$. These results were examined theoretically by the use of a perturbation theory based on spherical reference molecules. The importance of using a full non-axial treatment of the quadrupolar interactions between constituent molecules of the mixture is demonstrated. The effect of contributions to the free energy from the quadrupole-dispersion, anisotropic-dispersion and shape forces is shown to be of considerable importance in predicting the excess enthalpy. None of the intermolecular potential models studied was able to reproduce the shape of the excess-volume curve. (39 refs.)

119208 The unexpectedly high solubility of water in cryogenic liquids. R.Rebiai (Inst. of Cryogenics, Univ. of Southampton, Southampton, England), A.J.Rest, R.G.Scurlock.

Nature (GB), vol.305, no.5933, p.412-13 (29 Sept. 1983).

Confirms the unexpectedly high solubility of H_2O in liquid nitrogen (10.0×10^{-6} mole fraction), liquid oxygen (10.1×10^{-6} mole fraction) and liquid methane (60×10^{-6} mole fraction) at their respective normal boiling points by using Fourier transform IR spectroscopy. The possibilities of experimental artefacts are eliminated by parallel experiments with D_2O. (6 refs.)

119209 Active-coupling mixing times for a stirred binary liquid. N.Easwar, J.V.Maher, D.J.Pine, W.I.Goldburg (Dept. of Phys. & Astron., Univ. of Pittsburgh, Pittsburgh, PA, USA).

Phys. Rev. Lett. (USA), vol.51, no.14, p.1272-4 (3 Oct. 1983).

Mixing times measured for a stirred critical binary liquid mixture are seen to vary dramatically with Reynolds number, Prandtl number, and the initial value of the order parameter. These variations are far too large to be explained by passive-mixing calculations; they also differ in significant respects from the active-mixing predictions of Ruiz and Nelson. (8 refs.)

119210 Phase separation in blends of homopolymer and graft copolymer based on styrene and butadiene. Ming Jiang, Xiu-yun Huang, Tong-yin Yu (Chem. Dept. & Inst. of Material Sci., Fudan Univ., Shanghai, China).

Polymer (GB), vol.24, no.10, p.1259-66 (Oct. 1983).

A series of blends of homopolystyrene and styrene-*g*-butadiene copolymer with different combinations of molecular weights of the copolymer and graft polystyrene segments have been prepared. Phase separation behaviour of the blends has been examined by electron microscopy. The results reveal a regular change of morphology of the blends with the relative molecular weights of the free and graft polystyrene chains. The observed relationships between compatibility of the homopolymer and copolymer and the relative molecular weight are generally in agreement with that observed previously in homopolymer-block copolymer blends. Taking the inherent polydispersity of the molecular weight of the component polymers into account, some peculiarities of the morphologies of the blends have been explained. (22 refs.)

119211 Compatibility among chlorinated polyethylenes. C.Zhikuan, S.Ruona (Inst. of Chem., Acad. Sinica, Beijing, China).

Polymer (GB), vol.24, no.10, p.1279-85 (Oct. 1983).

Compatibility among chlorinated polyethylenes with different degrees of chlorination has been identified by the transparency of blended films cast from solvent. Dynamic mechanical measurements have been used to check these observations. The heats of mixing of pairs of chlorinated octadecanes with different degrees of chlorination have been measured and shown to be positive. It has been found that in this system, which is dominated by dispersion forces, compatibility is determined by similarity of the equation-of-state parameters. The Flory equation-of-state theory without the interaction entropy parameter Q_{12} generates a positive ΔG_m and hence fails to predict compatibility. A positive Q_{12} is needed to remedy this deficiency of the theory. This is in direct contrast to the negative Q_{12} which is introduced in the systems which are dominated by specific interactions. (12 refs.)

119212 Selective dissolution of dendritic or interdendritic phase in Sn-Al alloys. M.Datta, B.Giovanola, J.-L.Kolub (Materials Dept., Swiss Federal Inst. of Technol., Lausanne, Switzerland).

Prakt. Metallogr. (Germany), vol.20, no.8, p.394-405 (Aug. 1983). In English, German.

Anodic behavior of Sn, Al and their alloys has been studied in NaOH and K_2SO_4 solutions in order to determine conditions which lead to selective dissolution of an Sn-Al alloy. In this alloy Al dendrites grow in Sn matrix. Results obtained illustrate the usefulness of potentiostatic polarization in achieving selective dissolution of either Al dendrites or interdendritic Sn matrix. (19 refs.)

McMillan theory of binary smectic mixtures .... See Entry 118876

Relationships between miscibility grouping and smectic mesophase structure .... See Entry 118883

Investigations on demixing and crystallization behaviour of metallic glasses of the system palladium-nickel-phosphorus .... See Entry 118900

Structure and morphology of segmented polyurethanes. II. Influence of reactant incompatibility .... See Entry 118920

Lattice defects in (Hg,Cd)Te: investigations of their nature and evolution .... See Entry 119009

EBIC characterization of electrically active defects in (Hg,Cd)Te .... See Entry 119024

AES/STEM grain boundary analysis of stabilized zirconia ceramics .... See Entry 119025

Intergranular segregation and precipitation .... See Entry 119030

Kinetics of radiation-induced segregation in Ni-12.7 at.% Si .... See Entry 119073

Hydrogen bonding and other polar interactions of 1-,2-, and 4-octyne with organic solvents .... See Entry 119163

Application of the NRTL model for calculating phase equilibria in ternary systems with immiscibility gaps .... See Entry 119170

Electronic and elastic influences on the energetics of alloy formation .... See Entry 119220

A contribution to the associate model for binary liquid alloys .... See Entry 119233

A model for laser induced diffusion .... See Entry 119242

Permeation, diffusion, and solution of hydrogen isotopes, methane, and inert gases in/through tetrafluoroethylene and polyethylene .... See Entry 119269

Carbon segregation to the Pd(111) single crystal surface as seen in carbon monoxide thermal desorption spectra .... See Entry 119334

Kinetics of hydrogen absorption by α-zirconium .... See Entry 119336

A comparison of the uniaxial anisotropy in sputtered Co-Re and Co-Cr perpendicular recording media .... See Entry 119878

Light scattering from a Na_2O-SiO_2 glass with metastable phase separation .... See Entry 120105

Intergranular segregation phenomena studied by AES .... See Entry 120194

Sintering of tin oxide ceramic with additives .... See Entry 120291

Phase composition and phase stability of a high-chromium nickel-based superalloy, IN939 .... See Entry 120311

Phase equilibria in the ZnO-CdO-Fe_2O_3 system with a concentration of Fe_2O_3 of less than 50 mole % .... See Entry 120317

Interaction in the system ZrO_2-MgO-$MgCr_2O_4$ .... See Entry 120318

Structurally free cementite in low-carbon steels .... See Entry 120330

Cleaning effect of rare earths on grain boundary segregation in steels .... See Entry 120331

Microstructural characterization of doped dicalcium silicate polymorphs .... See Entry 120332

Electron microscopic investigations on a melt-quenched Al-Rh alloy .... See Entry 120333

Electron microprobe analysis of phase segregation in the Heusler alloy $Cu_{2.00}Mn_{1.00}Al_{1.00}$ .... See Entry 120334

Microanalytical investigation of sintered SiC. II. Study of the grain boundaries of sintered SiC by high resolution Auger electron spectroscopy .... See Entry 120335

Precipitation and solid solubility in the system NiO-Cr_2O_3 .... See Entry 120336

Intergranular segregation studies in steels using STEM-EDS X-ray microanalysis .... See Entry 120337

Formation of etch boundaries at the interface of Mo grains and a liquid Ni-Fe matrix during cyclic annealing .... See Entry 120338

An AEM investigation of the formation of precipitate-free zones in an Al-16 wt.% Ag alloy: determination of equilibrium and metastable solvus lines .... See Entry 120339

Long-term ageing characteristics of Hastelloy alloy X .... See Entry 120341

Ageing of austenitic iron alloys containing nitrogen .... See Entry 120353

Characteristic features of alloy polarization curves .... See Entry 120490

Isotope method detecting the hydride phase in palladium saturated with hydrogen .... See Entry 120523

Dissolution enthalpies of NaI in binary mixtures of water with aliphatic alcohols methylcellosolve at 298.15K. Enthalpic pair interaction coefficients of NaI-nonelectrolyte in water solution .... See Entry 120667

The solubility of calcite and aragonite in sweater at various salinities, temperatures, and one atmosphere total pressure .... See Entry 121211

Solubility of corundum in supercritical water .... See Entry 121216

64.80 OTHER PHASE PROPERTIES OF SYSTEMS

119213 High resolution electron microscopic study of oxide particles produced by the coalescence of smoke particles of iron and iron oxide. C.Kaito (Dept. of Phys., Kyoto Tech. Univ., Kyoto, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L432-4 (July 1983).
The structure of particles in a mixture of Fe smoke and γ-Fe_2O_3 smoke prepared by gas evaporation were investigated by crystal lattice imaging in high-resolution electron microscopy. Fe_3O_4, Fe_3O_4+Fe and $Fe_3O_4+\alpha$-Fe_2O_3 particles are formed by the coalescence of Fe and γ-Fe_2O_3 particles above 350°C. (14 refs.)

119214 Brownmillerite-type microdomains in the calcium lanthanum Ferrites: $Ca_xLa_{1-x}FeO_{3-y}$. I. $^2/_3<x<1$. M.A.Alario-Franco, J.M.Gonzales-Calbet, M.Vallet-Regi (Dept. de Quimica Inorganica, Univ. Complutense, Madrid, Spain), J.C.Grenier.
J. Solid State Chem. (USA), vol.49, no.2, p.219-31 (Sept. 1983).
The study by high resolution electron microscopy and electron diffraction of several oxidized samples of the calcium lanthanum ferrites $Ca_xLa_{1-x}FeO_{3-y}$, with different values of x and y, prepared at high temperatures in air, shows the existence of a microdomain texture in which brownmillerite-type microdomains with a volume of $\sim 10^6$ Å^3 are intergrown within a $Ca_2LaFe_3O_8$ substructure. This situation was not detected by conventional powder X-ray methods, where a simple cubic perovskite unit cell with constant parameters was observed ($a=3.849(1)$ Å for $x=0.8$ and $a=3.848(1)$ Å for $x=0.9$). Electron micrograph images of the microdomain texture show that fringe periodicity is very regular, suggesting that the oxygen excess is situated in the domain walls. (8 refs.)

119215 Deuterium short-range order in $Pd_{0.975}Ag_{0.025}D_{0.685}$ by diffuse neutron scattering. O.Blaschko, R.Klemencic, P.Fratzl, P.Weinzierl (Inst. fur Experimentalphys., Univ. Wien, Wien, Austria), G.Ernst, O.J.Eder, J.Kjems.
Phys. Rev. B (USA), vol.28, no.6, p.3579-81 (15 Sept. 1983).
By diffuse neutron scattering the D short-range order in a $Pd_{0.975}Ag_{0.025}D_{0.685}$ crystal was investigated at 50 and 70K. The results are compared with the D ordering in the PdD_x system previously investigated, and it is shown that the isointensity contours around the $(^1/_2,1,0)$ point are similar to that observed in $PdD_{0.71}$. One may conclude that the characteristic changes in the short-range-order intensity which occur near $x=0.7$ in PdD_x with concentration are due to changes of the electronic structure. (10 refs.)

An alternative approach to the quantitative determination of grain-size distribution in X-ray diffraction? A comment .... See Entry 118806

Melt growth and properties of B_6P crystals .... See Entry 118928

The search for a trivalent thulium monotelluride .... See Entry 118975

X-ray topographic studies of TEA$(TCNQ)_2$ crystals .... See Entry 119005

Thermodynamics of compounds with narrow ranges of nonstoichiometry .... See Entry 119219

Analysis of the stoichiometry and temperature dependence of cation diffusion in wustite, $Fe_{1-\delta}O$ .... See Entry 119255

Electronic and electrogalvanic properties of α silver telluride .... See Entry 119600

A comparison of the uniaxial anisotropy in sputtered Co-Re and Co-Cr perpendicular recording media .... See Entry 119878

Analysis and classification of layer-by-layer heterogeneities of microstructures .... See Entry 120156

Comments on 'Phase equilibria in the Mn_2O_3-Mn_3O_4-MnO system in CO_2-H_2 mixtures' .... See Entry 120319

Weld microstructure of $(Ni,Fe)_3(V,Ti)$ long-range-ordered alloy .... See Entry 120343

Microsctructure and composition of borided refractory metals .... See Entry 120512

The kinetics of the photolysis of thin films of tin diodide .... See Entry 120654

65.00 THERMAL PROPERTIES OF CONDENSED MATTER

(see also 05.70 Thermodynamics, 63. Lattice dynamics; for thermal conduction in nonmetallic liquids, see 66.60; for thermal conduction in nonmetallic solids, see 66.70; for electronic thermal conduction, see 72.15, 72.20 and 74.30E; for thermodynamic properties of quantum fluids, see 67.40, 67.50, and 67.60; for thermal properties of solid helium, see 67.80)

65.20 HEAT CAPACITIES OF LIQUIDS

On the correspondences between experimental sound velocities in liquid N_2O_4 with density and specific heat .... See Entry 119109

Smectic C-nematic transition in the mixtures 5_x6_{1-x}BABA .. See Entry 119193

65.40 HEAT CAPACITIES OF SOLIDS

(for specific heat of superconductors, see 74.30E; for specific heat of magnetic systems, see 75.40)

119216 Heat capacity of a five-coordinated iron (III) complex, iodobis(*N,N*-dimethyldithiocarbamato) iron (III), between 0.4 and 300K. M.Yoshikawa, M.Sorai, H.Suga, S.Seki (Dept. of Chem., Osaka Univ., Osaka, Japan).
J. Phys. & Chem. Solids (GB), vol.44, no.10, p.975-84 (1983).
The heat capacity of iodobis (*N,N*-dimethyldithiocarbamato)iron (III) has been measured between 0.4 and 300K. Based on the heat capacity and entropy at low temperatures it was found that the present sample consists of a mixture of monomer (*ca.* 40%) and dimer (*ca.* 60%); the former brings about a λ-type phase transition from an antiferromagnetic to a paramagnetic state at $T_N=(1.65\pm0.04)$K while the latter exhibits a Schottky-type anomaly due to antiferromagnetic dimeric coupling, the effect of which becomes dominant below *ca.* 0.7K. The zero-field splitting parameter of a single ferric ion was estimated to be $D/k=D_D/k=14$K for the monomer and the dimer, while the dimeric coupling constant was $J_D/k=-0.15$K. The entropy at low temperatures cannot be accounted for solely by the spin manifold. Additional contribution from a tunnel-splitting of the rotational levels of four constituent methyl-groups has been discussed. In this case, the level splitting of the ground state is 2.5 J mol^{-1} and the barrier height of hindering potential is 2.3 kJ mol^{-1}. (25 refs.)

119217 Low-temperature specific heat of vapour-deposited Ge_xSe_{1-x} glass (x=0.3). M.Mertig, G.Pompe, E.Hegenbarth (Wissenschaftsbereich Tieftemperaturphys., Sektion Phys., Tech. Univ. Dresden, Dresden, Germany).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K49-52 (Sept. 1983).
The binary system Ge_xSe_{1-x} is an amorphous semiconductor with a wide glass-forming region. The authors present the first measurement of the specific heat of an amorphous $Ge_{0.3}Se_{0.7}$ film system. The results are compared with results of an equivalent bulk sample in order to investigate the influence of the method of preparation. (15 refs.)

Ordering effects in the Fe-Al system .... See Entry 118892

Frequency spectrum, specific heat and Debye temperature of α-iron .... See Entry 119143

Effect of vitrification pressure on radius of gyration, specific heat and density of amorphous polymers .... See Entry 119198

Some Monte Carlo calculations for the Lennard-Jones solid .... See Entry 119229

Thermal expansion and isothermal compressibility of thallium telluride .... See Entry 119238

Thermal properties of doped and undoped $(CH)_x$ .... See Entry 119286

Heat capacity of diatomic molecules adsorbed on a periodic substrate and the localized-to-mobile transition .... See Entry 119340

Electronic properties of Cu-Ti metallic glasses .... See Entry 119542

Electronic properties of $Ca_{1-x}Al_x$ metallic glasses .... See Entry 119547

Magnetic behavior of Dy^{3+} ion in $Dy_2(SeO_4)_3.8H_2O$. Experimental and theoretical study including the effects of *J-J* mixing .... See Entry 119809

Magnetic and thermal behavior of $NiSnCl_6.6H_2O$ at low temperatures .... See Entry 119814

Low-temperature heat capacity of antiferromagnetic ternary rare-earth iron silicides $M_2Fe_3Si_5$ .... See Entry 119855

65.50 THERMODYNAMIC PROPERTIES AND ENTROPY

119218 Recent developments in the experimental determination of thermodynamic quantities of metals and alloys. K.L.Komarek (Inst. fur Anorganische Chem., Univ. Wien, Wien, Austria).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.709-17 (Sept. 1983).
Recent developments of experimental techniques for the measurement of thermodynamic quantities of metals and alloys are reviewed. Special emphasis is placed on calorimetry of reacting and nonreacting systems, EMF methods with liquid and solid electrolytes, and the various Knudsen effusion methods. (136 refs.)

119219 Thermodynamics of compounds with narrow ranges of nonstoichiometry. H.Schmalzried (Inst. fur Phys. Chem. und Elektrochem., Univ. Hannover, Hannover, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.726-33 (Sept. 1983).
Thermodynamic functions of compounds with narrow ranges of homogeneity are calculated with the aid of the concept of defect thermodynamics. In doing so, the irregular structural elements of a crystal are formally treated as quasi-particles in dilute solution on their respective sublattices. This concept is illustrated with binary and ternary ionic crystals (for example $Fe_{3-\delta}O_4$; $Ag_{2+\delta}S$; $Co_{1-\delta}O$; $(Co, Mg)_{1-\delta}O$; $(Fe, Mg)_{2-\delta}SiO_4$). The nonstoichiometry δ of these compounds is calculated as a function of the independent thermodynamic variables and compared with experimental results. (20 refs.)

119220 Electronic and elastic influences on the energetics of alloy formation. H.-J.Schaller (Inst. fur Phys. Chem., Univ. Kiel, Kiel, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.734-41 (Sept. 1983).
Palladium and platinum alloys have turned out to be useful subjects for relating thermodynamic properties with electronic and elastic quantities of the components. The mixing behavior of a number of interstitial and substitutional alloys exhibits analogous characteristics and may be interpreted by means of the same model. Two effects are discussed to account for nonideal properties. An 'electronic' effect is based on the observation that a number of alloy components behave as electron donors with respect to Pd and Pt. The charge transfer gives rise to a bonding contribution which is determined by the Fermi levels of the components and the valency of the solute. Extremely negative deviations from ideal mixing behavior have been predicted and observed upon adding unnoble components such as Al, Zr, Th or rare earth metals. For a number of Pd alloys the rise of the Fermi energy can be described as a function of the valence electron concentration only, irrespective of the particular donor. An 'elastic' effect is associated with the lattice distortion brought about by the dissolved particles. Models based on continuum elastic considerations are discussed in order to estimate the strain energy at infinite dilution. This quantity is correlated with the pair interaction energy in the quasichemical approach, which was used to calculate the concentration dependence of the elastic contribution. (36 refs.)

119221 High temperature thermodynamics of solutions of hydrogen and deuterium in palladium and its alloys. O.J.Kleppa (James Franck Inst., Univ. of Chicago, Chicago, IL, USA).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.741-9 (Sept. 1983).
The solutions of hydrogen in palladium and its alloys are classical examples of interstitial metallic solutions. Although these alloys have been studied for a very long time, a good deal of new information has become available in recent years, partly as a result of the application of the combined calorimetric-equilibrium approach. This experimental method allows essentially simultaneous determinations of the Gibbs energies, the enthalpies and the entropies of solution. This approach has been particularly essentially simultaneous determinations of the Gibbs energies, the enthalpies and the entropies of solution. This approach has been particularly useful in throwing new light on the temperature dependence of the thermodynamic properties, and also on their dependence on the alloying constituents. Special interest is attached to the new information on the partial entropies of hydrogen, which points strongly toward a temperature-dependent, nonrandom distribution of the hydrogen atoms among the available interstitial sites. (34 refs.)

119222 Enthalpy measurements on refractory metals and alloys by levitation calorimetry. M.G.Frohberg (Inst. fur Metall., Tech. Univ. Berlin, Berlin, Germany), G.Betz.
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.782-5 (Sept. 1983).
Measurements of enthalpy by levitation drop-calorimetry the principle of measurement, experimental data on Nb, Mo, Ta in solid and liquid states, determination of enthalpies of mixing by the levitation technique, temperature measurement and investigations of Fe-Cu and Nb-Si alloys are described. (13 refs.)

119223 Thermodynamic properties of Pt-B solid solutions. H.Brodowsky, H.Sagunski (Inst. fur Phys. Chem., Univ. Kiel, Kiel, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.803-5 (Sept. 1983).
The activity coefficients on B in Pt were determined at 1200 and 1300K by equilibrating Pt with B_2O_3 in a controlled H_2-H_2O atmosphere and measuring the weight gain. The partial molar excess Gibbs energies at vanishing B concentration are -44 and -43 kJ/mol., respectively. The atomic fractions at the solidus line are 0.036 and 0.031. A relative lattice contraction of the solid solutions prepared at 1200 and 1300K of $(1/a)(\partial a/\partial x_B)=-0.042$ and of -0.035 ± 0.002 was observed. This dependence of the lattice constant on the temperature of preparation suggests a mixed occupation of lattice and interstitial sites, with the majority of B atoms on lattice sites. (19 refs.)

119224 Thermodynamic properties of Pd-X-alloys, with X=Gd, Y, Ce. S.Paasch, H.-J.Schaller (Inst. fur Phys. Chem., Univ. Kiel, Kiel, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.812-14 (Sept. 1983).
Electromotive force measurements on cells with a CaF_2 solid electrolyte were used to determine the activities of Gd, Y, and Ce in Pd-rich alloys between 700°C and 800°C. The thermodynamic properties of these alloys are characterized by extreme negative deviations from ideal mixing behavior, up to -400 kJ/mol. for the partial molar excess Gibbs energy of Ce and up to -320 kJ/mol. for Gd and Y. The high thermodynamic stability of these alloys is attributed to a transfer of valence electrons to the electron gas of the alloy. At infinite dilution the resulting bonding contribution to the partial excess free energy is determined by the difference of the Fermi levels of the components and the valency of the solute. Including the size difference of the components as an additional effect, the mixing behavior of the alloys can be well described. Within the homogeneity ranges of the intermetallic phases Pd_3Y and Pd_3Gd the activities of the unnoble components increase by more than ten orders of magnitude. (12 refs.)

119225 Thermodynamics of liquid Na-Sn alloys using CaF_2 solid electrolytes. R.Alqasmi, J.J.Egan (Brookhaven Nat. Lab., Upton, NY, USA).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.815-17 (Sept. 1983).
The thermodynamic properties of mixing for liquid Na-Sn alloys were determined between 750°C and 850°C by EMF measurements using a CaF_2 solid electrolyte. Concentrations were controlled by coulometric titration. Results are presented for partial and integral Gibbs energies, entropies, and heats of mixing across the entire composition range. (13 refs.)

119226 Enthalpy-concentration data for the systems carbon tetrachloride-xylene. J.Wisniak (Dept. of Chem. Engng., Ben-Gurion Univ. of the Negev, Beer-Sheva, Israel).
Indian J. Technol., vol.21, no.3, p.105-8 (March 1983). [received: Oct. 1983]
Enthalpy-concentration data and boiling-point-composition correlations have been determined for the three binaries of xylene isomers with carbon tetrachloride at 760 mm Hg. This information should be useful for distillation studies. (8 refs.)

119227 Solid-state electrochemical study of (gallium+antimony) liquid alloys. T.J.Anderson, T.L.Aselage (Dept. of Chem. Engng., Univ. of Florida, Gainesville, FL, USA), L.F.Donaghey.
J. Chem. Thermodyn. (GB), vol.15, no.10, p.927-40 (Oct. 1983).
The activity of Ga in $\{x\mathrm{Ga}+(1-x)\mathrm{Sb}\}(1)$ alloys was measured in the high-temperature galvanic cells: $\mathrm{Pt}|\mathrm{C}|\mathrm{Ga}_x\mathrm{Sb}_{1-x}(1)$, β-$\mathrm{Ga_2O_3(cr)}|\mathrm{CSZ}|y_1\mathrm{CO}+y_2\mathrm{CO_2}+(1-y_1-y_2)\mathrm{Ar}|\mathrm{C}|\mathrm{Pt}$ and $\mathrm{Pt}|\mathrm{C}|\mathrm{Ga}_x\mathrm{Sb}_{1-x}(1)$, β-$\mathrm{Ga_2O_3(cr)}|\mathrm{CSZ}|\mathrm{Ga}(1)$, β-$\mathrm{Ga_2O_3(cr)}|\mathrm{C}|\mathrm{Pt}$, using calcia-stabilized zirconia (CSZ) as the solid electrolyte and either $\{y_1\mathrm{CO}+y_2\mathrm{CO_2}+(1-y_1-y_2)\mathrm{Ar}\}(g)$ or the two-phase $(\mathrm{Ga}+\beta\text{-}\mathrm{Ga_2O_3})$ as the reference electrode. Moderate deviations in activities from Raoult's law were found. The results of this study were found to be in excellent agreement with reported calorimetric results and liquidus temperatures. Several models were examined and the non-random two-liquid equation was found to represent best the activities reported in this work. (39 refs.)

119228 Effects of inhomogeneities in polyacrylamide gels on thermodynamic and transport properties. Tsong-Pin Hsu, Dong Sung Ma, C.Cohen (School of Chem. Engng., Cornell Univ., Ithaca, NY, USA).
Polymer (GB), vol.24, no.10, p.1273-8 (Oct. 1983).
The difference in swelling of polyacrylamide gels of various polymer concentrations and the nuclear magnetic resonance self-diffusion measurements of water in these gels suggest that inherent inhomogeneities in dilute gels play an important role in the thermodynamic and transport properties of these gels. (18 refs.)

119229 Some Monte Carlo calculations for the Lennard-Jones solid. E.R.Cowley (Dept. of Phys., Camden Coll. of Arts & Sci., Rutgers State Univ., Camden, NJ, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3160-3 (15 Sept. 1983).
Monte Carlo calculations of the thermodynamic and elastic properties of a classical nearest-neighbor Lennard-Jones solid have been carried out, for comparison with previous calculations using the cell-cluster method. The agreement between the results obtained by the two methods is very good. The dependence of the Monte Carlo results on sample size and on number of configurations was investigated. A simple correction for finite sample size is shown to be very accurate. (8 refs.)

119230 Problems in the thermodynamic description of real crystals. V.E.Panin, S.G.Psakh'e, A.I.Landa.
Sov. Phys. J. (USA), vol.25, no.12, p.1148-54 (Dec. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.12, p.95-102 (Dec. 1982). [received: Oct. 1983]
The authors consider the question of thermodynamic description of a real crystal with consideration of temperature effects and displacement of atoms from the ideal lattice points. (40 refs.)

119231 Investigation of thermodynamic behaviour of oxygen in copper bismuth melts at 1200°C. S.Anik, M.G.Frohberg, M.L.Kapoor (Inst. fur Metall., Tech. Univ. Berlin, Berlin, Germany).
Z. Phys. Chem., Wiesbaden (Germany), vol.133, no.2, p.167-74 (1982). In German. [received: Oct. 1983]
EMF measurements were performed by means of magnesia stabilized zirconia, in order to determine the thermodynamic behaviour of oxygen in molten Cu-Bi solvents at 1200°C. The free enthalpy of dissolution of the oxygen at infinite dilution as standard state is reported along with the interaction parameters after C. Wagner (1952). Various existing thermodynamic models are applied to interpret the experimental data. (13 refs.)

119232 Enthalpy of formation and transformation in binary and ternary systems of the metals iron, cobalt, nickel and molybdenum. O.Kubaschewski, T.Hoster (Rheinisch-Westfalischen Tech. Hochschule Aachen, Aachen, Germany).
Z. Metallkd. (Germany), vol.74, no.9, p.607-9 (Sept. 1983).
A simple high temperature calorimeter is used to measure the enthalpy of formation and transformation in the systems Fe-Mo, Ni-Mo, Co-Mo,Fe-Co-Mo, Ni-Co-Mo and Fe-Ni-Mo in the temperature range 800 to 1300 °C. (8 refs.)

119233 A contribution to the associate model for binary liquid alloys. U.Gerling, M.J.Pool, B.Predel (Max-Planck-Inst. fur Metallforschung Stuttgart, Stuttgart, Germany).
Z. Metallkd. (Germany), vol.74, no.9, p.616-19 (Sept. 1983).
After a brief survey over the development of the model of associates, five fundamentals of this theory are formulated. On the basis of these ideas the thermodynamic equations for a binary liquid solution with one kind of associates are established and explained. A method of calculation is given for the case of an approximated solution for the computation of the model parameters out of the thermodynamic data of a real binary system. (32 refs.)

Geometric relaxation in water: its role in hydrophobic hydration .... See Entry 118835

McMillan theory of binary smectic mixtures .... See Entry 118876

Thermotropic homopolyesters. Investigation of the smectic phase of polyesters based on *p,p'*-bibenzoic acid .... See Entry 118887

Experimental investigation on the thermal stability of metallic glasses .... See Entry 118895

Glass forming ability of alloys on the basis of Fe-C .... See Entry 118899

Application of thermodynamic models in phase diagram assessment .... See Entry 119148

Investigation of the melting point of thin films as a method of determining their elastic energy .... See Entry 119161

Hydrogen bonding and other polar interactions of 1-,2-, and 4-octyne with organic solvents .... See Entry 119163

The use of lattice theory in the calculation of excess properties of fluid mixtures. VI. Prediction of Gibbs' free energies and enthalpies of mixing of binary systems using model by Tompa .... See Entry 119201

Enthalpy coefficients of pairwise interactions between polar molecules and long-chain aliphatic ions in water at 298.15K .... See Entry 119206

Thermodynamics of liquid mixtures of nitrous oxide and ethene .... See Entry 119207

Heat capacity of a five-coordinated iron (III) complex, iodobis(*N,N*-dimethyldithiocarbamato) iron (III), between 0.4 and 300K .... See Entry 119216

Thermal pressure and thermal expansion coefficients and thermodynamic values derived at 298.15K for binary mixtures of methylcyclohexane+linear alkanes .... See Entry 119235

Thermodynamic behavior of impurity atoms in α-range alloys of the noble metals and nickel .... See Entry 119268

The low temperature P-T phase diagram of TTF-TCNQ .... See Entry 119577

Electronic and electrogalvanic properties of α silver telluride .... See Entry 119600

On the Co-Ti system .... See Entry 120313

Experimental aspects of solid galvanic cell methods for thermodynamic studies on alloys .... See Entry 120314

Thermodynamic aspects of mechanical behavior of glassy polymers .... See Entry 120366

Equilibrium decomposition pressures of the compounds Cs_2ZrCl_6 and Cs_2HfCl_6 and X-ray identification of Na_2HfCl_6, K_2HfCl_6, and Cs_2HfCl_6 .... See Entry 120666

Dissolution enthalpies of NaI in binary mixtures of water with aliphatic alcohols methylcellosolve at 298.15K. Enthalpic pair interaction coefficients of NaI-nonelectrolyte in water solution .... See Entry 120667

Decomposition of β-alumina in an oxygen potential gradient .... See Entry 120729

65.70 THERMAL EXPANSION AND THERMOMECHANICAL EFFECTS

(see also 64.30 Equations of state; for electronic thermal conduction, see 72.15 and 72.20; for thermal conductivity of superconductors, see 74.30E; for pyroelectric and electrocaloric effects, see 77.70)

119234 Thermal expansivity of α-$LiIO_3$ between 20 and 520K. S.C.Abrahams, R.Liminga, P.Marsh, F.Schrey (Bell Labs., Murray Hill, NJ, USA), J.Albertsson, C.Svensson, A.Kvick.
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.453-7 (1 Oct. 1983).
The lattice constants of hexagonal α-$LiIO_3$ have been measured both by single-crystal neutron and X-ray diffractometry and by dilatometry in the range 20 to 520K. The phase transition to γ-$LiIO_3$ takes place at about 520K. At 295K, $a=5.48127(6)$ and $c=5.17165(4)$ Å for λ(Cu $K\alpha_1$)=1.540598 Å. The expansion is nonlinear and is fitted by the third-order polynomial $a_i^T=a_i^{295}[1+\alpha_i\Delta T+\beta_i(\Delta T)^2+\gamma_i(\Delta T)^3]$ with $a_1=25.3(3)$, $\alpha_3=46.1(3)\times10^{-6}K^{-1}$, $\beta_1=23.0(8)$, $\beta_3=39(1)\times10^{-9}K^{-2}$, and $\gamma_1=-25(7)$, $\gamma_3=-47(9)\times10^{-12}K^{-3}$, with $\Delta T=T-295K$. The principal thermal expansion coefficients $\alpha_i^T=\alpha_i^{295}[1+A_i\Delta T+B_i(\Delta T)^2]$ increase monotonically with temperature, gradually approaching 32×10^{-6} K^{-1} for the *a* and $56\times10^{-6}K^{-1}$ for the *c* axis from values at 20K of 7.1 and $14.2\times10^{-6}K^{-1}$, respectively. (18 refs.)

119235 Thermal pressure and thermal expansion coefficients and thermodynamic values derived at 298.15K for binary mixtures of methylcyclohexane+linear alkanes. A.Griot, R.Philippe, J.-C.Merlin (Univ. de Lyon I, Villeurbanne, France).
J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.6, p.507-13 (June 1983). In French.
Thermal pressure coefficients (β_m) and expansion coefficients (α_m) were measured at 298.15K for binary mixtures of methylcyclohexane and n-alkane (n-hexane, n-octane, n-dodecane and n-hexadecane). Thermal pressure coefficients are measured using a direct method and expansion coefficients using a pycnometric method. The choice of methylcyclohexane is explained by the peculiarity of this molecule due to the presence of the methyl group on the ring. The experimental data are interpreted by Flory's theory using enthalpy of mixing (H^E). The difference between these data and theory are explained by the 'order-disorder' effect that is not integrated by the theory. Another interpretation is made using the excess values β^E, α^E and V^E obtained from the experimental mixing data. The V^E (obtained from ρ_m) are found to increase with the number of carbons of the alkane, while the values of β^E decrease as the length of the alkane increases. These results are explained by the creation of disorder by the methylcyclohexane in long chain molecules like n-dodecane and n-hexadecane. The excess values for expansion coefficients are all negative and this result is in agreement with conclusions on the free volume of mixtures. (28 refs.)

119236 Thermal expansion of organic conductors. A.Krause, H.W.Schafer, H.W.Helberg (Drittes Phys. Inst., Univ. Gottingen, Gottingen, Germany).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1429-32 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Thermal expansions are measured in three crystal directions ([010] (stack); ⊥[010] in (100); ⊥ (100); principal directions of the conductivity tensor) of the semiconducting salt methyltriphenylarsonium-$(TCNQ)_2$ using an optical interference technique. The maximum thermal expansion coefficient is found in the stack direction. The thermal expansion of the conductors TTF-TCNQ, $(TMTSF)_2(FSO_3)$, and $(Pe)_2(AsF_6)_{0.75}$ $(PF_6)_{0.35}$.O.85 CH_2Cl_2 is measured along the stack directions with the microwave cavity perturbation technique in the skin effect regime. Debye-temperatures for these directions are calculated. (7 refs.)

119237 Low temperature thermal expansion of soda-borate glasses. E.S.Pinango, S.Vieira, R.Villar (Dept. de Fisica Fundamental, Univ. Autonoma de Madrid, Madrid, Spain).
Solid State Commun. (USA), vol.48, no.2, p.143-5 (Oct. 1983).
The thermal expansion of glassy $(B_2O_3)_{1-x}(Na_2O)_x$, for $x=0.06$, 0.16 and 0.25 has been measured in the temperature range $4K<T<20K$. The results are analysed in terms of a polynomial $\alpha=aT+bT^{+}+cT^5+dT^7$ and the values of the coefficients are discussed. The linear term *a* is small and positive in the three glasses. This yields a small and positive Gruneisen parameter for the two level systems. The cubic term is negative and is not affected by change in coordination, phonon dispersion being responsible for the fast increase in thermal expansion on increasing the temperature. (15 refs.)

119238 Thermal expansion and isothermal compressibility of thallium telluride. M.A.Aldzhanov, K.K.Mamedov, D.A.Guseinov, A.B.Abdullaev (Inst. of Phys., Acad. of Sci., Baku, Azerbaidzhan SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.540-1 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.937-8 (March 1983). [received: Oct. 1983]
The authors report a study of the thermal expansion coefficient (α) and of the isothermal compressibility (κ_t) of TlTe in the region of the second-order phase transition, and the results of a calculation of the specific heat at constant volume (C_v), Gruneisen parameter, and other characteristics of atomic vibrations from the values of α and κ_t obtained at temperatures 4.2-350K. (5 refs.)

Structural aspects of substituted morpholinium TCNQ complexes .... See Entry 118893

Properties and structure of glasses in the system $10K_2O\cdot20Ba0\cdot70(SiO_2,GeO_2,B_2O_3)$ .... See Entry 118897

New calcium gallates of lanthanum and neodymium .... See Entry 118964

Density of liquid $Hg_{1-x}Cd_xTe$ .... See Entry 119080

The magnetic and magnetoelastic properties of amorphous metallic ribbons .... See Entry 119891

65.90 OTHER TOPICS IN THERMAL PROPERTIES OF CONDENSED MATTER

On interaction of thermo-acoustic waves with the process of phase transition: a continuous approach. I. Constitutive equations and propagation velocities .... See Entry 119114

Transitions and relaxations in mesophase polymers: thermotropic liquid crystalline polyesters with mesogenic groups in the main chain .... See Entry 119194

66.00 TRANSPORT PROPERTIES OF CONDENSED MATTER (NONELECTRONIC)

66.10 DIFFUSION AND IONIC CONDUCTION IN LIQUIDS

119239 Study of the phenomena of saline diffusion in a solar pond without convection to control stability. M.C.de Andres, J.Doria (Facultad de Ciencias Fisicas, Univ. Complutense, Madrid, Spain).
An. Fis. Ser. B (Spain), vol.79, no.2, p.182-7 (May-Aug. 1983). In Spanish. [received: Oct. 1983]
An experimental prototype for the indoors simulation of a solar pond behavior has been developed. In this prototype the evolution of the physics parameters involved with the nonconvecting zone stability, such as temperature and density profiles, are controlled. The diffusion and Soret coefficients have been measured in this system at the working temperature interval of a real solar pond. (3 refs.)

119240 Isothermal transport properties in solutions of symmetrical tetra-alkylammonium bromides. L.A.Woolf (School of Phys. Sci., Australian Nat. Univ., Canberra, Australia), H.Weingartner.
Faraday Symp. Chem. Soc. (GB), no.17, p.41-53 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
Density, molar conductance, transference number, tracer diffusion (cation, anion, water) and mutual diffusion data are reported for aqueous solutions of the following symmetrical tetra-alkylammonium halides at 25°C up to 2 mol kg^{-1} concentration: Me_4NBr, Et_4NBr, n-Pr_4NBr and n-Bu_4NBr. These data were used to obtain information on the interactions between pairs of species c, a, w (cation, anion, water) using Hertz's velocity-correlation formalism. Within this formalism the transport coefficients are related to time integrals over velocity cross-correlation functions between the various interaction partners. Results obtained for solutions of tetra-alkylammonium salts differ characteristically from those reported for alkali halides and reflect structural features such as hydrophobic hydration, cation-cation and anion-anion interactions. (30 refs.)

119241 Diffusion coefficients of binary liquid mixtures using ultracentrifuge. T.M.Aminabhavi, E.S.Jayadevappa, B.R.Prasad (Dept. of Chem., Karnatak Univ., Dharwad, India).
Indian J. Chem. A, vol.22A, no.3, p.231-3 (March 1983). [received: Oct. 1983]
Mutual diffusion coefficients of five pairs of binary solvent mixtures have been measured using the recently developed ultracentrifuge technique, over a range of compositions at 25°C. These data, when compared with literature values obtained from different techniques, show reasonably good agreement. (20 refs.)

119242 A model for laser induced diffusion. E.Fogarassy, R.Stuck, M.Toulemonde, D.Salles, P.Siffert (Groupe de Phys. et Applications des Semi-conducteurs, Strasbourg, France).
J. Appl. Phys. (USA), vol.54, no.9, p.5059-63 (Sept. 1983).
A model for laser induced diffusion is proposed, assuming the melting of a Si surface under pulsed laser irradiation and the diffusion, in liquid phase, of a thin film deposited impurity. Depending on the thickness of the film, it results in a dopant distribution profile with a surface disordered layer induced either by segregation effects or precipitation of the dopant in excess of the solubility limit achieved by laser annealing. Experimental results obtained for a ruby laser irradiation of thin films of various dopants such as Sb, Ga, Bi, and In deposited on Si substrates are in good agreement with the model. (20 refs.)

119243 Washburn numbers. V. Relative solvent transport numbers for ion constituents in the dioxan+water and dimethylsuphoxide+water systems. D.Feakins, R.D.O'Neill, W.E.Waghorne (Dept. of Chem., Univ. Coll., Dublin, Ireland).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.10, p.2289-98 (Oct. 1983).
For pt.IV see ibid., vol.78, p.143, 1982. Washburn numbers $w_w{}^\circ=(n_+)_w{}^\circ t_+-(n_-)_w{}^\circ t_-$ for the alkali-metal chlorides in the dioxan+water

system are reported. These and values previously determined for the dimethylsulphoxide (DMSO)+water system have been combined with the Erdey-Gruz numbers $\Sigma n_w{}^\circ=(n_+)_w{}^\circ+(n_-)_w{}^\circ$ for these systems, also determined, to give the relative solvent transport numbers n_w for alkali-metal and chloride ions. The variation of n_w with solvent composition in the range 0-40% (w/w) (x_2=0-0.09) of organic solvent shows quite different patterns for each solvent mixture. The main features can be explained on the basis that small concentrations of DMSO enhance the three-dimensional structure of water, whilst dioxan breaks it down at all concentrations; that the behaviour of the ions is influenced by changes in both the total dynamic solvation number and the degree of preferential solvation; and that the smaller ion-solvent complexes tend to carry the current preferentially. (11 refs.)

119244 Molar volumes and mobilities of some divalent transition-metal cations in dimethylformamide. W.Grzybkowski, M.Pilarczyk (Dept. of Phys. Chem., Tech. Univ. of Gdansk, Gdansk, Poland).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.10, p.2319-31 (Oct. 1983).
The apparent molar volumes and molar conductivities are reported for the Mn^{II}, Co^{II}, Ni^{II} and Zn^{II} perchlorates in dimethylformamide solution at 25°C. The limiting molar conductivities and molar volumes of the cations are derived and discussed in terms of the nature of the solvated complexes existing in solutions that are responsible for charge transport due to the cations. (36 refs.)

119245 Model calculations on the electric conductivity of the N_c phase. P.J.Photinos, A.Saupe (Dept. of Phys., Kent State Univ., Kent, OH, USA).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.91-7 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
A theoretical study of the electric conductivity of a system consisting of a body-centered tetragonal lattice of insulating cylinders, embedded in a uniform and isotropic conducting medium is presented. The model is described by three parameters: the volume fraction occupied by the cylinders (here taken to be less than 50%): the diameter to length ratio of the cylinders, d/l; and the ratio of the minimum distances between cylinders normal and parallel to the cylinder axis, ξ. The authors find that the conductivity anisotropy is in general smaller than the value corresponding to infinitely long cylinders. The anisotropy can assume both positive and negative values. The sign is largely determined by the ratio ξ. The usefulness of the model in relation to the N_c lyotropic mesophase is discussed. (6 refs.)

119246 Diffusion of spheres in a concentrated suspension: resummation of many-body hydrodynamic interactions. C.W.J.Beenakker, P.Mazur (Inst.-Lorentz, Rijksuniv. Leiden, Leiden, Netherlands).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.22-4 (3 Oct. 1983).
The authors evaluate the wavevector dependent (short-time) diffusions coefficient $D(k)$ for spherical particles in suspension. The analysis is valid up to high concentrations and fully takes into account the many-body hydrodynamic interactions between an arbitrary number of spheres. By resumming moreover a certain class of correlations, they obtain results which agree well with available experimental data for the small and large wavevector limits of $D(k)$. (7 refs.)

119247 Fat-simulating and accelerating solvents for polyolefins and MWD of solvent extracts of polyethylenes. Shu-Sing Chang, W.J.Pummer, J.R.Maurey (Polymer Sci. & Standards Div., NBS, Washington, DC, USA).
Polymer (GB), vol.24, no.10, p.1267-72 (Oct. 1983).
Migration kinetics of straight-chain oligomers and antioxidants from several polyolefins at different temperatures into various solvents have been studied by radioactive tracer techniques. Anhydrous ethanol appears to be a well suited food-oil or liquid-fat simulant for extracting different types of migrants from polyolefins. Pure and mixed triglycerides are also good oil or fat simulants, but the triglycerides offer no simpler analytical procedures than the use of oil or fat themselves. n-Octanol may also be considered as a reasonable oil or fat simulant; however, its action depends somewhat on the choice of migrants. The accelerating action of n-heptane over that of oil or simulants is quantitatively demonstrated. The accelerating effects are greater for migration systems with lower diffusion coefficients. The diffusion coefficients for migration into n-heptane are about 20 times greater than the diffusion coefficients into ethanol or oil for otherwise identical migration systems yielding diffusion coefficients of about 10^{-7} cm^2 s^{-1} into oil or ethanol. For systems yielding diffusion coefficients into oil or ethanol of about 10^{-12} cm^2 s^{-1}, the corresponding diffusion coefficients into n-heptane are about 1000 times greater. The molecular weight distributions (MWDs) of the n-heptane and ethanol extracts of polyolefins have been analysed. n-Heptane can not only accelerate the migration of the individual migrant but also remove oligomer species that are slightly soluble or present at low levels in the oil or simulant extracts. (10 refs.)

Effects of inhomogeneities in polyacrylamide gels on thermodynamic and transport properties .... See Entry 119228

Influence of diffusion of electrophoretic deposition in a uniform electric field .... See Entry 120636

Pulse radiolysis conductivity measurements in aqueous solutions with nanosecond time resolution .... See Entry 120660

66.20 DIFFUSIVE MOMENTUM TRANSPORT

(inc. viscosity of liquids)

119248 Isothermal transport of liquids through cellulose acetate membranes. J.I.Mengual, F.Garcia Lopez (Facultad de Fisica, Univ. Complutense, Madrid, Spain).
An. Fis. Ser. B (Spain), vol.79, no.2, p.121-7 (May-Aug. 1983). [received: Oct. 1983]
Isothermal permeation of methanol, ethanol and water through cellulose acetate membranes has been studied as a function of temperature in the 30-45°C range. Permeability increases with temperature in all cases. Experimental results are analysed in terms of three transport models. All the models lead to the conclusion that the transport mechanism is clearly viscous. The correlation between pore radius and liquid-membrane system is discussed. (16 refs.)

119249 Viscosity and longest relaxation time of semi-dilute polymer solutions. I. Good solvent. M.Adam, M.Delsanti (Lab. Leon Brillouin, CENS, Gif-sur-Yvette, France).
J. Phys. (France), vol.44, no.10, p.1185-93 (Oct. 1983).
The zero shear viscosity and longest relaxation time are measured for semi-dilute polystyrene benzene solutions. For monomer concentrations c smaller than 10% and over a large range of the reduced concentration c/c^* where c^* is the overlap concentration ($4<c/c^*<70$), the authors find that: both the relative viscosity η_r and the longest relaxation time T_R divided by the first mode characteristic time T_1 of a single chain are functions of the reduced concentration c/c^* only; the shear elastic modulus is independent of the molecular weight. (26 refs.)

119250 Shear viscosity in rapidly quenched states. M.Tanaka (Dept. of Engng. Sci., Tohoku Univ., Sendai, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.2970-2 (Sept. 1983).
The shear viscosity η is calculated in rapidly quenched states of a model of liquid rubidium by the molecular dynamics method. During the rapid-quenching process, η is proportional to kT/D (Stokes' law) down to about one third of the melting point T_m, while the proportionality does not hold at lower temperatures. The change of the slope of ln η vs. $1/T$ suggests a structural change from super-cooled liquid to a glassy state around $T_m/3$, which is consistent with the results of molecular dynamics calculations of the structure. The value of η is obtained as 0.58 cP just above T_m and reaches to 14.6 cP in the final quenched state around the liquid helium temperature.

119251 Effect of trace impurity levels on the viscosity of vitreous silica. P.P.Bihuniak, A.Calabrese, E.M.Erwin (Quartz & Chem. Products Dept., General Electric Co., Richmond Heights, OH, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.134-5 (Aug. 1983).
The transformation-range viscosity dependence of vitreous silica on Al_2O_3 (25 to 350 molar ppm) and alakali oxide (1.0 to 75 molar ppm) was investigated. Viscosity increased with the molar ratio Al_2O_3/alkali oxide up to $\approx$8 and was constant at higher ratios. (6 refs.)

119252 The effect of addition of suspension PVC and VC-VAc copolymers on the rheological properties of modified PVC plastisols. E.Makarewicz (Akad. Tech.-Rolnicza, Bydgoszcz, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.4, p.117-19 (April 1983). In Polish. [received: Oct. 1983]
The results of determination of some rheological properties of PVC plastisols have been presented. The effect of addition of PCW S-68 and a VC-VAc copolymer to plastisols based on PCW E-68P modified with the Kreolak resin on the changes in critical stress, viscosity and energy of activation of viscous flow has been investigated. Just prepared plastisols and plastisols after ageing have been tested. A mathematical treatment of the effect of time of ageing on the rheological properties of modified plastisols has been presented. The same treatment has been applied to plastisols containing the above mentioned additives of PCW S-68 and VC-VAc copolymer. (4 refs.)

119253 The effect of polymolecularity and branching on the dependence of the melt flow index on the limiting viscosity number. Z.Dobkowski (Instytut Chemii Przemyslowej, Warszawa, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.1, p.10-11 (Jan. 1983). In Polish. [received: Oct. 1983]
Based on the results of studies on bisphenol-A polycarbonates an empirical relationship between the melt flow index and limiting viscosity number, polymolecularity index and degree of branching of polymer has been presented and the coefficients of the regression equation calculated. This relationship can be used in the evaluation of the presence of branched macromolecules in the polymer. The molten-state viscosity of polymer increases with an increase in the polymolecularity index and in the content of branchings. (8 refs.)

Role of cations in the conformation of iota and kappa carrageenan .... See Entry 118006

Transition phenomena in polystyrene near the theta condition .... See Entry 118020

Stokes-Maxwell relations for the distorted fluid microstructure .... See Entry 118840

Packing and conformational contributions in binary liquid mixtures: acoustic studies of n-hexadecane with dimethylpentanes .... See Entry 118851

The rotational viscosity of nematic liquid crystal mixtures at low temperatures .... See Entry 118864

Molar volumes and fluidities of seed oils and their fatty acids .... See Entry 119081

LCST behaviour in blends of PMMA with PVC .... See Entry 119203

66.30 DIFFUSION IN SOLIDS

Photostimulated diffusion in semiconductors .... See Entry 119063

Diffusion instability of the steady-state oxidation of metals . See Entry 120511

66.30D Theory of diffusion and ionic conduction in solids

119254 Atomic transport via point defects in crystals. I. General kinetic theory of diffusion. A.D.Franklin, A.B.Lidiard (Theoretical Phys. Div., AERE, Harwell, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1797, p.405-31 (8 Oct. 1983).
Presents a general formulation of the kinetic theory of solid state diffusion applicable to systems showing small degrees of vacancy and interstitial disorder. These equations are solved in the linear approximation, specifically for steady state conditions. The results verify the correctness of the phenomenological equations provided by non-equilibrium thermodynamics including the Onsager reciprocal relation. This theory includes previous kinetic theories made for a variety of systems as special cases and shows how systematic improvements in accuracy can be made within this framework. The relations between this theory and alternative theories, those derived from the Einstein-Smoluchowski equation and from Kubo linear response theory, are briefly touched upon. (32 refs.)

119255 Analysis of the stoichiometry and temperature dependence of cation diffusion in wustite, $Fe_{1-\delta}O$. R.A.McKee (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3007-13 (15 Sept. 1983).
A generalized thermodynamic representation of diffusion in high-defect-concentration solids is reviewed. This formalism permits a description of diffusion phenomena (metal oxidation, ionic conductivity, thermomigration) in terms of equilibrium thermodynamic properties, the tracer diffusion coefficient, and the correlation factor. This phenomenological theory is then applied in an analysis of experimental data for chemical diffusion in $Fe_{1-\delta}O$. Moreover, the theory-experiment comparison allows the ΔK parameter associated with an isotope strength measurement to be determined. With values of ΔK, the corresponding correlation factor that is obtained from an isotope strength measurement can be evaluated. It is seen that the correlation factor for iron diffusion in $Fe_{1-\delta}O$ decreases with an increase in the deviation in stoichiometry and decreases with an increase in temperature. These phenomena are discussed in terms of defect structures that have been proposed for this material. (28 refs.)

119256 Correlation factors for atomic diffusion in nondilute multicomponent alloys with arbitrary vacancy concentration. R.A.Tahir-Kheli (Dept. of Phys., Temple Univ., Philadelphia, PA, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3049-56 (15 Sept. 1983).
Vacancy-assisted tracer diffusion in a multicomponent kinetic alloy consisting of $x^{\lambda}N$ atoms with hopping rate J^{λ} (where $\lambda \equiv A,B,C$, etc.) and νN vacancies (where $\nu = 1 - \Sigma_{\lambda} x^{\lambda}$) distributed randomly over a regular d-dimensional (where $d \geq 2$) hypercubic, or close-packed, lattice of N sites is analyzed through a self-consistent renormalization of a recent theory of Tahir-Kheli and Elliott combined with a generalization of concepts introduced by Manning. The result for the tracer-diffusion correlation factor is the following: $f^{tr} = H''(tr)/[H''(tr) + 2J^0]$, where J^0 is the tracer-hopping rate, $H''(tr)$ is a generalized effective vacancy escape frequency, $H''(tr) = M/(1-\nu)[J^0 \nu f^{tr} + J^{eff}]$, where J^{eff} is an effective hopping rate of the background atoms averaged with a weighting factor proportional to x^{λ} and f^{λ}, i.e. $J^{eff} = \Sigma_{\lambda}(J^{\lambda} x^{\lambda} f^{\lambda})/\Sigma_{\lambda}(x^{\lambda} f^{\lambda})$ and $M = -(1 + \langle \cos\theta \rangle)/\langle \cos\theta \rangle$. For a single-component alloy, with particle concentration x, $J^{\lambda} = J$, and vacancy concentration $\nu = 1 - x$, the author's theory provides an excellent overall description of the correlation factor as long as $J/J^0 \gtrsim z^{-2}$. Indeed, even for $J \rightarrow O$, the calculated results agree with the Monte Carlo estimates, except in the immediate vicinity of the percolation threshold, ν_p, which is located self-consistently to an accuracy of the order $1/z$. (18 refs.)

The differential equations for the processes of statistical kinematics in solids .... See Entry 117119

The silver iodide-thallium iodide pseudo-binary system .... See Entry 119156

Dynamic bond percolation theory: A microscopic model for diffusion in dynamically disordered systems. I. Definition and one-dimensional case .... See Entry 119259

Decomposition of β-alumina in an oxygen potential gradient .... See Entry 120729

66.30H Self-diffusion and ionic conduction in nonmetals

119257 Proton conductivity in the layer compound $H_3OUO_2AsO_4.3H_2O$ (HUAs). I. Conductivity in the orthorhombic low-temperature phase and the vehicle mechanism of proton transport in solids. K.D.Kreuer, A.Rabenau (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany), R.Messer.
Appl. Phys. A (Germany), vol.A32, no.2, p.45-53 (Oct. 1983).
The proton conductivity in $H_3OUO_2AsO_4.3H_2O$ (HUAs) has been measured below the transition temperature at 299K. A consistent picture of the elementary process taking place is developed from separate electrochemical, spectroscopic and calorimetric measurements. The conductivity is proposed to occur by the 'vehicle mechanism' of proton transport, i.e. the cooperative motion of H_3O^+ and H_2O. This mechanism is compared with the Grotthuss and the simple ion hopping mechanism. (58 refs.)

119258 Diffusion mobility of anions in fluorides of the elpasolite structure. V.A.Vopilov, V.N.Voronov, V.M.Buznik (L.V. Kirenskii Phys. Inst., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1628-31 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1893-5 (Nov. 1982).
Samples in the systems $2KF\text{-}AF\text{-}BiF_3$ (where A is Na, K, and Rb) have been synthesized and the ^{19}F NMR studied. Intense diffusional motion of the fluorine anions was observed at temperatures significantly below the melting temperatures of the crystals studied. The magnitudes of the activation energies for diffusional motion of the fluorine ions were estimated. (10 refs.)

119259 Dynamic bond percolation theory: A microscopic model for diffusion in dynamically disordered systems. I. Definition and one-dimensional case. S.D.Druger, A.Nitzan, M.A.Ratner (Dept. of Chem., Northwestern Univ., Evanston, IL, USA).
J. Chem. Phys. (USA), vol.79, no.6, p.3133-42 (15 Sept. 1983).
A dynamic bond percolation model is defined and studied. The model is intended to describe diffusion of small particles (ions, electrons) in a medium which is statistically disordered (as in ordinary bond percolation), but which is also undergoing dynamic rearrangement processes on a timescale short compared to the observation time. The model should be applicable to polymeric solid electrolytes, where the orientational motions of the polymer (which are responsible for configurational entropy) cause the dynamic motion of the medium (polymer) in which the small particles (alkali ions) diffuse. The model is characterized by three parameters: an average hopping rate w which appears in the master equation for hopping, a percentage of available bonds f, and a mean renewal time $\bar{\tau}_{ren}$ for dynamic motion of the medium to rearrange the assignments of closed and open bonds. The authors show that the behavior is always diffusive for observation times long compared to $\bar{\tau}_{ren}$, in agreement with experiment on polymeric solid electrolytes. They also derive a closed-form expression for the diffusion coefficient. For observation times smaller than the renewal time there is no diffusion, again in accord with the behavior of polymeric solid electrolytes below the glass transition temperature. The diffusion coefficient is a monotonically increasing function of the inverse renewal time and hence of the free volume, the configurational entropy, and the temperature. (20 refs.)

119260 Electrical conductivity of $Sc_2O_3\text{-}ZrO_2$ compositions by 4-probe DC and 2-probe complex impedance techniques. S.P.S.Badwal (Div. of Materials Sci., CSIRO, Melbourne, Victoria, Australia).
J. Mater. Sci. (GB), vol.18, no.10, p.3117-27 (Oct. 1983).
The ionic conductivities of several samples in the $Sc_2O_3\text{-}ZrO_2$ system (Sc_2O_3:~8 mol.%) have been measured using 4-probe DC and 2-probe complex impedance dispersion techniques. Samples which contained monoclinic zirconia showed hysteresis effects and S-shaped Arrhenius conductivity plots. This behaviour was assigned to the $m\text{-}ZrO_2 \rightleftharpoons t\text{-}ZrO_2$ transformation. In samples which were free of monoclinic ZrO_2, contributions from the grain boundary resistance were relatively small. The Arrhenius plots of their conductivity showed a distinct change in the slope around 600°C towards higher activation energy and this was attributed to vacancy trapping. The 4-probe DC data could be fitted to an equation of the form $\rho = A_1 T \exp(E_1/RT) + A_2 T \exp(E_2/RT)$. The process which dominated the conduction mechanism at lower temperatures had an activation energy of 130 to 140 kJ mol^{-1}. The activation energy for the migration of oxygen ion vacancies within the bulk of the grain was 64 to 70 kJ mol^{-1}. (25 refs.)

119261 Change of conduction mechanism with gamma dose of irradiated borosilicate glasses containing copper ions. A.Tawansi, H.Dowediar (Dept. of Phys., Mansoura Univ. Mansoura, Egypt), M.M.Morsi, S.A.Khairy.
J. Phys. & Chem. Solids (GB), vol.44, no.10, p.961-6 (1983).
The DC electrical resistivity of sodium borosilicate glasses containing copper ions has been measured at the temperature range 300-623K before and after gamma irradiation. The results obtained indicate that conduction may proceed ionically for the unirradiated glasses, with an activation energy in the range 23-24.2 Kcal/mol. Relatively low gamma doses (3.6 Mrads) induce two regions, separated at a critical temperature (T_c), of different activation energies. An activation energy E_1, 3.4 Kcal/mol, in the temperature range from 300-370K, and E_2 16.8-20.9 Kcal/mol, in the range of higher temperatures. The mechanism suggested is that the ionic conduction is replaced by an electronic one up to about 370K then seems to be replaced at higher temperature region by ionic-like mechanism which can be expressed by exciton-like process. High gamma doses (28.33 M rads) cause the glasses to have activation energy ranges between 19.9-22.7 Kcal/mol, which may substantiate the predominance of the proposed ionic-like mechanism. The transition region around T_c seems to be divided into three regions, precritical, critical and post-critical. (25 refs.)

119262 Effect of surface condition on oxygen self-diffusion coefficients for single-crystal Al_2O_3. Y.Oishi, K.Ando, N.Suga (Dept. of Nuclear Engng., Kyushu Univ., Fukuoka, Japan), W.D.Kingery.
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.130-1 (Aug. 1983).
Oxygen self-diffusion coefficients were determined for two Al_2O_3 single crystals by the isotope-exchange technique, using chemically polished and Ar-ion-milled samples. Results represented by $D = 562 \exp[-665(kJ/mol)/RT]$ cm^2/s are lower than those for diamond-paste-finished samples and near Reed and Wuensch's results (see ibid., vol.63, p.88-92, 1980). The oxygen diffusion coefficient determined using crushed particles and the microscopically measured ratio of surface area to volume agreed with these values. (8 refs.)

119263 Effect of ratio of surface area to volume on oxygen self-diffusion coefficients determined for crushed $MgO\text{-}Al_2O_3$ spinels. K.Ando, Y.Oishi (Dept. of Nuclear Engng., Kyushu Univ., Fukuoka, Japan).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.131-2 (Aug. 1983).
Oxygen self-diffusion coefficients for single-crystal $MgO\text{-}Al_2O_3$ spinels previously determined for crushed particles were recalculated using the microscopic surface area of the sample, as was done for alumina. The corrected results agree well with those of Reddy and Cooper (see ibid., vol.64, p.368-71, 1981). (5 refs.)

119264 Enhanced oxygen diffusion at 1400°C in deformed single-crystal magnesium oxide. A.F.Henriksen, Y.-M.Chiang, W.D.Kingery (MIT, Cambridge, MA, USA), W.T.Petuskey.
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.144-6 (Aug. 1983).
The rate of oxygen diffusion at 1400°C into pure, deformed, and scandium-doped MgO was measured using a secondary-ion mass spectrometer with $^{16}O^-$ primary ions as sputtering agents to monitor the penetration of ^{18}O into the sample from an ^{18}O-enriched surface layer. In samples doped with scandium, oxygen diffusivity did not differ significantly from the value, 1.3×10^{-15} cm^2/s, found for the pure sample. In deformed samples, the diffusion coefficient was 5.8×10^{-15} cm^2/s. (14 refs.)

119265 Self-diffusion in gallium arsenide. H.D.Palfrey, M.Brown, A.F.W.Willoughby (Southampton Univ., Southampton, England).
J. Electron. Mater. (USA), vol.12, no.5, p.863-77 (Sept. 1983).
The self-diffusion of arsenic in gallium arsenide has been studied over the temperature range 1000 to 1075°C using radiotracer techniques. ^{76}As was diffused into GaAs samples at known arsenic pressures in sealed capsules. After diffusion, layers were removed from the surface using anodic oxidation followed by oxide dissolution. Diffusion profiles were obtained by measuring the ^{76}As concentration in each sectioned layer by γ-radiation counting. Results are discussed in terms of native point defect equilibria with the arsenic gaseous phase, and with respect to other work. It is deduced from the observed arsenic pressure dependence of the arsenic diffusivity that the most likely diffusion mechanism for As is via vacancies on its own sublattice. (16 refs.)

119266 Diffusion of fluorine ions in yttrium iron garnet. B.Antonini, P.Paroli (Istituto di Elettronica dello Stato Solido, CNR, Roma, Italy).
Phys. Rev. B (USA), vol.28, no.6, p.3422-6 (15 Sept. 1983).
The diffusion of F^- ions in yttrium iron garnet has been induced for the first time and investigated by magneto-optical techniques. Crystals of composition $Y_{3-x}Ca_xFe_5O_{12-x}F_x$ (with $x \approx 0.3$) were grown, and diffusion of F^- ions out of the sample was induced by high-temperature annealing in oxygen. The replacement of F^- with O^{2-} ions induces Fe^{4+} ions, whose magnetic circular dichroism in the near-infrared is used as a sensitive monitor of the diffusion process. This phenomenon can be well described in terms of the classical diffusion equation with a diffusion coefficient D uniform and constant, temperature activated according to the law $DK = D_0 \exp(-E/kT)$, with $D_0 = 6.5 \pm 1.0$ cm^2 s^{-1} and $E = 3.42 \pm 0.15$ eV. These values might indicate that microscopically the F^-, O^{2-} ion exchange occurs with the intervention of an anion vacancy. (17 refs.)

119267 Effect of inertial forces on ionic transport in superionic conductors. N.N.Vershinin, Yu.I.Malov, E.A.Ukse (Inst. of New Chem. Problems, Acad. of Sci., Moscow, USSR).
Sov. Electrochem. (USA), vol.19, no.1, p.92-3 (Jan. 1983). Translation of: *Elektrokhimiya (USSR)*, vol.19, no.1, p.102-3 (Jan. 1983). [received: Sept. 1983]
One can assume in order to explain the high conductivity of superionic conductors that the mobile ions are in a relatively free state, i.e. that they are weakly bound to particular crystallographic positions, and participate in continuous motion along channels of the more or less rigid crystal structure. This model admits of a certain analogy between the mobile ions in superionic conductors and the 'free' electrons in metals. The direct proof for 'free' electrons being the charge carriers in metals had been obtained in experiments of Tolman (1976), who measured the electric current generated in a metal when this was subjected to acceleration and the 'free' electrons were lagging relative to the motion of the metal's rigid crystal lattice. The authors have studied the effect of inertial (centrifugal) force on ionic transport in superionic conductors. (4 refs.)

Melt growth and properties of B_6P crystals .... See Entry 118928

Lattice defects in (Hg,Cd)Te: investigations of their nature and evolution .... See Entry 119009

AES/STEM grain boundary analysis of stabilized zirconia ceramics .... See Entry 119025

Properties of glasses in the system $AgI\text{-}Ag_2O\text{-}B_2O_3$ .... See Entry 119197

Diffusion of gold and mercury self-diffusion in *n*-type Bridgman-grown $Hg_{1-x}Cd_xTe(x \simeq 0.2)$ .... See Entry 119270

Mixed electrical conduction in sintered BCC $6Bi_2O_3.SiO_2$ ..... See Entry 119669

Origin of the low electronic component of the electrical conductivity of solid electrolytes based on $\beta\text{-}Al_2O_3$ .... See Entry 119674

EPR and ionic thermocurrents experiments on cubic solid solutions $Sr_{1-x}Eu_xF_{2+x}$ .... See Entry 119909

^{19}F nuclear relaxation study of the fluorite systems: $K_{0.36}Bi_{0.64}F_{2.28}$ .... See Entry 119947

Formation of the crystal structure of the ferrite $BaFe_{12}O_{19}$ ..See Entry 119954

Experimental aspects of solid galvanic cell methods for thermodynamic studies on alloys .... See Entry 120314

66.30J Diffusion, migration, and displacement of impurities

119268 Thermodynamic behavior of impurity atoms in α-range alloys of the noble metals and nickel. T.Hehenkamp (Inst. fur Metallphys., Univ. Gottingen, Gottingen, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.806-11 (Sept. 1983).
Thermodynamic data for dilute α-range alloys are necessary to understand atomic migration. Such data, however, are very scarce in the literature and contradict each other in many cases. A comparison is presented between the results of different experimental techniques particularly designed to measure partial thermodynamic quantities at low impurity concentrations. The results for 1-B-noble metal alloys are surprisingly uniform and indicate an electronic origin of the dependence of the excess potentials on concentration, if the impurity atom has the same ion core as the host metal. If the impurity atom exhibits a much different ion core, a minimum in the excess chemical potential becomes observable at low concentrations. The reason could be either a size misfit or a dependence of the excess functions on the atomic mass. The viewpoint of the mass dependence is corroborated by results in the Ag-As system, which is characterized by almost no size misfit but a different atomic mass, and some recent measurements in nickel alloys. (33 refs.)

119269 Permeation, diffusion, and solution of hydrogen isotopes, methane, and inert gases in/through tetrafluoroethylene and polyethylene. H.Miyake, M.Matsuyama, K.Ashida, K.Watanabe (Tritium Res. Center, Toyama Univ., Toyama, Japan).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1447-51 (1983).
Permeation of three hydrogen isotopes, methane, and inert gases were measured for a tetrafluoroethylene (TFE) and a polyethylene (PE) film at room temperature by means of the time-lag method in order to establish physicochemical properties which determine the solubility and the diffusivity of these gases. It was observed that the diffusion constant of the inert gases changed exponentially with the heat of vaporization, and their solubility constant was an exponential function of the Lennard-Jones force constant of the gases for both films. On the other hand, hydrogen isotopes and methane deviated from these relations. It is concluded that the dispersive force plays an important role for the solution and the diffusion of the inert gases, whereas chemical interactions between the solute and the solvent play an important role. (14 refs.)

119270 Diffusion of gold and mercury self-diffusion in *n*-type Bridgman-grown $Hg_{1-x}Cd_xTe(x\simeq0.2)$. M.Brown, A.F.W.Willoughby (Engng. Materials Lab., Univ. of Southampton, Southampton, England).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1641-5 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
The diffusion behavior of mercury in $Hg_{0.8}Cd_{0.2}Te$ was investigated using radiotracer techniques. Complex concentration versus distance profiles resulted from both the gold and mercury diffusion anneals. At 225°C, complementary error function curve fits to the surface and tail components of the mercury diffusion profile yielded diffusion coefficients of $\simeq 8\times10^{-14}$ and $\simeq 2.5\times10^{-11}$ $cm^2\ s^{-1}$ for the surface and tail regions, respectively. Mercury diffusion coefficients were similar for as-grown and mercury preannealed samples. Surface concentrations were unknown for the gold diffusion profiles and accurate diffusion coefficient calculations were not made, but the migration rate of gold appeared faster than mercury in $Hg_{0.8}Cd_{0.2}Te$. A mechanism was proposed for depletion of gold in the near-surface region of the HgCdTe for long diffusion times in a mercury ambient, which involved the formation of Au/Hg compounds at the slice surface. (8 refs.)

119271 Oxidation enhanced and concentration dependent diffusions of dopants in silicon. S.Matsumoto, Y.Ishikawa (Dept. of Electrical Engng., Keio Univ., Yokohama, Japan), T.Niimi.
J. Appl. Phys. (USA), vol.54, no.9, p.5049-54 (Sept. 1983).
Diffusions of impurities in silicon under oxidizing ambient and under extrinsic conditions have been analyzed by developing the Hu's model. The general expression of diffusion coefficient, which includes both the vacancy and interstitial mechanisms, is used. The temperature dependences of a fraction of the interstitial mechanism for arsenic f_{As}, phosphorus f_P, and boron f_B are obtained from the data of oxidation enhanced diffusion (OED) and oxidation induced stacking faults. $f_{As}=42\exp(-0.542/kT)$, $f_P=156\exp(-0.666/kT)$, and $f_B=860\exp(-0.829/kT)$. Time dependence of OED and the concentration dependence of the diffusion coefficient of arsenic and boron under extrinsic conditions can be explained by this model. (49 refs.)

119272 Examination of models for Zn diffusion in GaAs. A.H.van Ommen (Philips Res. Labs., Eindhoven, Netherlands).
J. Appl. Phys. (USA), vol.54, no.9, p.5055-8 (Sept. 1983).
Concentration profiles of Zn in GaAs have been calculated for two models: the Frank-Turnbull model involving Schottky defects and the 'kick-out' model involving gallium Frenkel defects. Comparison with experimental data shows that the latter model gives a better description. This indicates that Frenkel defects play a predominant role in this diffusion process. (14 refs.)

119273 n-type doping of $(CH)_x$: molecular diffusion of the dopant. F.Rachdi, P.Bernier, E.Faulques, S.Lefrant, F.Schue (Groupe de Dynamique des Phases Condensees, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.97-100 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Studies the kinetics of the n-type doping of cis-$(CH)_x$ films using lithium-benzophenone solutions in THF. Raman spectroscopy shows that cis-trans isomerization occurs during the doping process. By following the evolution of the ESR spectra, the authors were able to deduce both the interfibrillar and the intrafibrillar diffusion coefficients. (8 refs.)

119274 The diffusivity of hydrogen in Nb stabilized stainless steel. R.A.Outlaw (NASA, Langley Res. Center, Hampton, VA, USA), D.T.Peterson.
Metall. Trans. A (USA), vol.14A, no.9, p.1869-73 (Sept. 1983).
The evolution of hydrogen from 347 stainless steel has been studied by using a real time dynamic technique under ultrahigh vacuum conditions. Auger electron spectroscopy was used to determine the surface composition as a function of time and temperature. The surface film on the electropolished samples was found to be approximately 15 Å thick and consisted of a carbon-oxygen complex and a metal oxide (Fe_xO_y). Upon heating to 400°C, the carbon-oxygen complex desorbed as CO and the remaining oxygen and carbon began to incorporate. Also at this temperature sulfur began to diffuse out of the bulk to the surface and at approximately 800°C formed a complete monolayer. At 900°C, carbon and oxygen virtually disappeared, leaving the monolayer of sulfur as the only surface contaminant. The hydrogen diffusivity was found to follow closely the equation $D=7.01\times10^{-7}\exp[-48.0/RT]$ m^2 per second over the entire temperature range studied, thus indicating that hydrogen evolution is not significantly affected by the changing surface composition. (7 refs.)

119275 Diffusion of water in NaCl bicrystals. L.B.Harris, S.L.Bewlay (Dept. of Appl. Phys., Univ. of New South Wales, Kensington, New South Wales, Australia).
Phys. Status Solidi a (Germany), vol.79, no.1, p.243-50 (Sept. 1983).
Measurement of the variation in the light scattered from precipitates produced by moisture diffusing along a grain boundary is developed into a method for determining the grain boundary diffusion coefficient D of the water. Suitable treatment of data from nominally pure bicrystals enables an approximate value for D at room temperature to be obtained by two independent methods. (19 refs.)

119276 Resonant dependence of molecular diffusion through a fine-pore filter on the IR-illumination intensity. V.A.Kravchenko, Yu.N.Petrov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.573-4 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1330-2 (Nov. 1982). [received: Sept. 1983]
The authors report a study of how the intensity of an illuminating laser beam affects the flux density of resonant molecules through a fine-pore filter. In the experiments they use a CO laser system built around an ILGN-704 industrial laser. The filter is a mica wafer 1 cm in diameter and 40 μm thick, with a pore size $\sim$50 Å. The authors studied the diffusion of toluene molecules, which have absorption lines in the spectral region corresponding to the output of the CO laser. The flux density of molecules is measured with a KM-2 quadrupole mass spectrometer. (3 refs.)

119277 Ion migration activation energy measurements in silicon dioxide. D.Schipanski (Tech. Hochschule Ilmenau, Ilmenau, Germany).
Wiss. Z. Tech. Hochsch. Ilmenau (Germany), vol.29, no.3, p.145-52 (1983). In German.
The trapping or gettering of contaminating ions in materials used for semiconductor processing is studied, using thermally induced ion currents (TSIC) between 20 deg C and 350 deg C, where a drift field of 10^5 volts per cem was applied. The concentration of ion traps is calculated and temperature ion current spectra for Al-SiO_2(HCl)-Si samples are reproduced. It is stated that activation energies can be determined to a resolution of 0.1 eV. (9 refs.)
G.M.E.

Precision interplanar spacing measurements of boron-doped silicon .... See Entry 118958

Radiation-induced mobility of lithium and sodium in alpha-quartz .... See Entry 119069

Kinetics of hydrogen absorption by α-zirconium .... See Entry 119336

Growth kinetics of platinum silicide .... See Entry 119360

Electronic and ionic transport properties of electrodeposited polypyrrole films .... See Entry 119607

Passivation of intragrain defects by copper diffusion in p-type polycrystalline silicon .... See Entry 119630

Gold diffusion through silicon dioxide .... See Entry 119706

Carrier depletion in sulfur doped epitaxial GaAs layer by boron ion implantation .... See Entry 119721

Structure and kinetics of some paramagnetic oxygen centres in synthetic calcium fluoride crystals .... See Entry 119914

Studio della decarburazione e scagliatura nei forni di riscaldo per laminazione a caldo (Study of the decarbunization and scaling ocurring in reheating furnaces for hot rolling) .... See Entry 120516

66.30L Diffusion, migration, and displacement of other defects

119278 Influence of defects on the diffusion of helium in calcium fluoride. E.V.Popov, A.Ya.Kupryazhkin, I.R.Shein (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.521-2 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.906-8 (March 1983). [received: Oct. 1983]
The authors have eliminated the influence of radiation defects on diffusion transport of He^4 in CaF_2 by desorption in a two-cell diffusion chamber in which samples were saturated separately in one of the cells at the measurement temperature under a helium pressure of $\sim$3 atm for a period $t>3\tau$, where τ is the relaxation time of the diffusion process; this was followed by a determination (after transfer to another cell in vacuum) of outgassing of the crystals. The diffusion of He^4 in CaF_2 was studied in the temperature range 773-1363K. The temperature dependence of the diffusion coefficient of helium in the investigated samples had a kink at about 930K. (12 refs.)

Correlation factors for atomic diffusion in nondilute multicomponent alloys with arbitrary vacancy concentration .... See Entry 119256

Examination of models for Zn diffusion in GaAs .... See Entry 119272

Diffusion of water in NaCl bicrystals .... See Entry 119275

66.30N Chemical interdiffusion

119279 Interaction of thin layers of Al and Ge with cleaved (Hg,Cd)Te surfaces. G.D.Davis, N.E.Byer (Martin Marietta Labs., Baltimore, MD, USA), R.R.Daniels, G.Margaritondo.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1726-9 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
The interaction of $Hg_{0.72}Cd_{0.28}Te$ substrates with submonolayer-deposited films of Al and Ge has been investigated by ultraviolet photoelectron spectroscopy (UPS) using a synchrotron radiation source. The surfaces of the *p*-type samples were formed by cleaving in ultrahigh vacuum—a process which resulted in *n*-type surfaces. Very thin layers of Al(0.2-1 Å) were found to interact very strongly with the surface, causing a dramatic loss in the amount of Hg at the surface and a much smaller loss of Cd. As a result, the measured Cd/Hg concentration ratio increased by more than a factor of 2 for 1 Å of Al. At the same time, the valence-band features shifted downwards in energy, reflecting an apparent change in the local band gap. In contrast, Ge was relatively inert with regard to the cleaved surface and caused little

change in the substrate composition. The behavior of both deposited films can be predicted from the decreasing thermodynamic stability of Al_2Te_3, CdTe, HgTe, and GeTe and may be important to the formation of good Ohmic contacts. (18 refs.)

119280 Kinetics of $TiSi_2$ formation by thin Ti films on Si. L.S.Hung, J.Gyulai, J.W.Mayer (Cornell Univ., Ithaca, NY, USA), S.S.Lau, M.-A.Nicolet.
J. Appl. Phys. (USA), vol.54, no.9, p.5076-80 (Sept. 1983).
Silicide formation with Ti deposited on single crystal Si and Ti deposited on amorphous Si layers sequentially without breaking the vacuum was investigated using backscattering spectrometry and glancing-angle X-ray diffraction. For Ti deposited on amorphous Si, $TiSi_2$ was formed with a rate proportional to $(time)^{1/2}$ and an activation energy of 1.8 ± 0.1 eV. For Ti deposited on single crystal Si, the reaction rate was slower and the silicide layer was nonuniform in thickness. The authors attribute the difference in behavior to the presences of interfacial impurities in the case where Ti was deposited on single crystal Si. (19 refs.)

119281 Influence of boron on chemical interdiffusion in SiC during conversion of silicon fibers to SiC. K.M.Friederich (Max-Planck-Inst. fur Metallforschung, Inst. fur Werkstoffwissenschaften, Stuttgart, Germany), R.L.Coble.
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.141-2 (Aug. 1983).
The influence of boron additions on the diffusivities of Si and C in SiC was studied by modifying an experiment described by Kato and Okabe (see ibid., vol.63, p.236, 1980). The diffusivities of both species are considerably enhanced by adding as little as 10 ppb boron. A method to investigate the transport mechanisms in SiC is provided by this modified experiment. (8 refs.)

119282 An analysis of concentration profiles for fluxes, diffusion depths, and zero-flux planes in multicomponent diffusion. M.A.Dayananda (Purdue Univ., West Lafayette, IN, USA).
Metall. Trans. A (USA), vol.14A, no.9, p.1851-8 (Sept. 1983).
Concentration profiles developed during isothermal, multicomponent diffusion for a single-phase, solid-solid diffusion couple are expressed on the basis of a relative concentration variable for each component and analyzed for the determination of interdiffusion fluxes. The individual concentration profiles intersect at a common cross-over composition where the relative concentrations of all components are identical. New relations are developed for describing internal consistency among the concentration profiles of the various components. A link is made between the cross-over composition and the depths of the diffusion zone on either side of the Matano plane for a diffusion couple. The identification of a zero-flux plane from concentration profiles is also described. A single phase Cu-Ni-Zn diffusion couple annealed at 775°C is used for illustration. (33 refs.)

(HgCd)Te-SiO_2 interface structure .... See Entry 119353

66.30Q Electromigration

119283 Electric field enhanced diffusion in polyacetylene. J.H.Kaufman (Inst. for Polymers & Organic Solids, Univ. of California, Santa Barbara, CA, USA), A.J.Heeger, R.Kaner, E.J.Mele, A.G.MacDiarmid.
J. Phys. Colloq. (France), vol.44, no.C-3, p.577-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
A theory is developed which shows how high power and current densities can be generated by a $(CH)_x$ battery cell despite the slow diffusion and low conductivity characteristic of ionic motion in polyacetylene. The presence of a small driving potential (or a load) causes current to flow and generates a large electric field in the fibrils when the electronic screening length is of the order of a fibril radius. This field dramatically increases the ion transport rate. (7 refs.)

66.60 THERMAL CONDUCTION IN NONMETALLIC LIQUIDS

(for thermal conduction in liquid metals, see 72.15C)

Measured thermal diffusivity of $Hg_{1-x}Cd_xTe$ solids and melts ....See Entry 119284

Thermal conductivity of crystals: a molecular-dynamics study of heat flow in a two-dimensional crystal .... See Entry 119288

66.70 NONELECTRONIC THERMAL CONDUCTION AND HEAT-PULSE PROPAGATION IN NONMETALLIC SOLIDS

(for thermal conduction in solid metals, see 72.15C and 72.15E; for statistical mechanics of lattice vibrations, see 63.70)

119284 Measured thermal diffusivity of $Hg_{1-x}Cd_xTe$ solids and melts. L.R.Holland (NASA/Space Sci. Lab., Marshall Space Flight Center, AL, USA), R.E.Taylor.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1615-19 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
The thermal diffusivity of $Hg_{1-x}Cd_xTe$ melts is found to rise rapidly with temperature to values characteristic of metals. Solid and melt diffusivities for values of x from 0 to 0.3 and over a temperature range from 150 to 900°C have been determined by the laser flash method of Parker, Taylor, and Cowan. The diffusivity decreases from a maximum at $x=0$ in both the solid and the liquid, with the values observed at $x=0.3$ being about 40% of those for $x=0$. The solid diffusivity for $x=0$ is 1.7 mm^2/s at 150°C decreasing to 0.7 mm^2/s at the melting point. The $x=0$ liquid diffusivity increases from 0.7 mm^2/s at the melting point to 3.5 mm^2/s at 900°C. (16 refs.)

119285 Thermal conductivity of lead sulfide-based solid solutions. K.Sh.Kakhramanov, S.A.Aliev (Phys. Inst., Acad. of Sci., Azerbaidzhan SSR).
Inorg. Mater. (USA), vol.18, no.10, p.1460-4 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1700-4 (Oct. 1982). [received: Sept. 1983]
Thermal conductivities were studied in the quasibinary and quasiternary systems PbS-PbSe, PbS-PbTe, PbS-Sb, and PbS-PbSe-PbTe. Electron and lattice contributions to the thermal conductivity were calculated bearing in mind the nonparabolic conduction band. At $T \geq 300K$ all the lead sulfide based solid solutions were found to be affected by disordering and normal processes of phonon scattering in a comparable manner to Umklapp processes. Here, the main contribution to additional thermal resistance in PbS-PbTe, PbS-Sb, and PbS-PbSe-PbTe systems was a result of local elasticity changes. (14 refs.)

119286 Thermal properties of doped and undoped $(CH)_x$. G.Leising, H.Kahlert (Inst. fur Festkorperphys., Tech. Univ. Graz, Graz, Austria).
J. Phys. Colloq. (France), vol.44, no.C-3, p.111-14 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Measurements of the thermal conductivity of undoped cis-$(CH)_x$ and trans-$(CH)_x$ and of iodine-doped cis-$(CH)_x$ in the temperature range between 60K and 300K are reported and compared to the results of other authors. Adopting a very simple morphological model the authors estimate from their data the thermal conductivity of individual $(CH)_x$-fibres. In addition, values for the specific heat of cis- and trans-$(CH)_x$ are determined and the activation energy for the cis-trans-isomerization is obtained for differential-scanning-calorimetry experiments. (9 refs.)

119287 Lattice thermal conductivity of crystals with dislocations. M.A.Ansari, A.Kumar, B.K.Srivastava (Dept. of Phys. & Meteorology, Indian Inst. of Technol., Kharagpur, India).
Phys. Status Solidi b (Germany), vol.119, no.1, p.113-19 (1 Sept. 1983).
The thermal conductivity of crystals containing dislocations is calculated using Kubo's relation. The correlation function is obtained using the projection operators are suggested by Wilson and Kim (1973). It is observed that the phonon scattering by the strain field due to the dislocations is proportional to the phonon frequency and is anisotropic is nature. (12 refs.)

119288 Thermal conductivity of crystals: a molecular-dynamics study of heat flow in a two-dimensional crystal. R.D.Mountain, R.A.MacDonald (Thermophys. Div., NBS, Washington, DC, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3022-5 (15 Sept. 1983).
The authors have studied steady-state heat flow in a two-dimensional crystal by the method of molecular dynamics. The model system contains 1000 particles on a triangular lattice interacting via the Lennard-Jones potential. The system is 50 unit cells long and 10 unit cells wide. They find that the thermal conductivity κ of this system is consistent with $1/T$ behavior as expected when phonon-phonon scattering is the dominant mechanism for thermal resistance. They have also carried out similar calculations for three-dimensional Lennard-Jones systems in both fluid and crystalline configurations. The results for the fluid were in good agreement with earlier calculations but for the FCC solid system, 16 unit cells in length, κ was independent of temperature. They determined that boundary scattering was the dominant resistive mechanism in this case. To escape the boundary-limited regime, the length of the three-dimensional crystal needs to be increased by at least a factor of 3. It is feasible to simulate a system of this size with the use of modern computers. (22 refs.)

119289 Thermal conductivity of an imperfect anharmonic crystal. D.N.Sahu, P.K.Sharma (Phys. Dept., Univ. of Allahabad, Allahabad, India).
Phys. Rev. B (USA), vol.28, no.6, p.3200-13 (15 Sept. 1983).
The thermal conductivity of an anharmonic crystal containing randomly distributed substitutional defects due to impurity-phonon scattering is theoretically investigated with the use of the method of double-time thermal Green's functions and the Kubo formalism considering all the terms, i.e. diagonal, nondiagonal, cubic anharmonic, and imperfection terms in the energy-flux operator as propounded by Hardy (1963-6). The study uses cubic, quartic anharmonic, and defect terms in the Hamiltonian. Mass changes as well as force-constant changes between impurity and host-lattice atoms are taken into account explicitly. It is shown that the total conductivity can be written as a sum of contributions, namely diagonal, nondiagonal, anharmonic, and imperfection contributions. For phonons of small halfwidth, the diagonal contribution has precisely the same form which is obtained from Boltzmann's transport equation for impurity scattering in the relaxation-time approximation. The present study shows that there is a finite contribution of the nondiagonal term, cubic anharmonic term, and the term due to lattice imperfections in the energy-flux operator to the thermal conductivity although the contribution is small compared with that from the diagonal part. The authors have also discussed the feasibility of numerical evaluation of the various contributions to the thermal conductivity. (23 refs.)

Cooperation of free- and bound-electron-phonon scattering in Sb-doped Ge ....See Entry 119137

67.00 QUANTUM FLUIDS AND SOLIDS; LIQUID AND SOLID HELIUM

(see also 05.30 Quantum statistical mechanics)

67.40 BOSON DEGENERACY AND SUPERFLUIDITY OF HELIUM-4

119290 Measurement of the transient heat transfer to liquid helium from a thin metal film. B.A.Danil'chenko, V.N.Poroshin (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Cryogenics (GB), vol.23, no.10, p.546-8 (Oct. 1983).
A method to measure transient heat transfer to liquid helium from a thin metal film heater under the condition of pulsed heating during $\tau \leq 400$ ns is proposed. The experimental equipment used for the measurements is described. The method is based on the comparison of heat pulses transfered from the heater into a monocrystal substrate which is surrounded either by vacuum or by liquid helium. The method can also be used to investigate the heat flux density transmitted into liquid helium over a wide region of thermal loads. Experimental results showing the heat flux density radiated from a Cu heater into liquid helium at 3.8K as a function of the electric power fed into the heater by pulses of 200-400 ns duration are demonstrated. (8 refs.)

119291 Influence of three-body correlations in the spectrum of elementary excitations in liquid ^4He. S.Kilic (Fakultet Gradevinskih Znanosti, Split, Yugoslavia).
Fizika (Yugoslavia), vol.15, no.3, p.263-72 (July-Sept. 1983).
Using the variational ansatz the author obtained an appropriate expression for the energy of elementary excitations. Reduction to the Jackson-Feenberg form and the numerical computation pointed out the necessity for precision in the perturbation calculation. He also analysed the influence of three-body correlation on the Jackson-Feenberg spectrum in the convolution approximation. Consequently he used and tested in this way the Feenberg as well as Woo form of the three-body correlation part of the wave function. It was demonstrated that the influence of Feenberg's three-body correlations on convolution approximation is actually insignificant. The same is correct for Woo correla-

tion in phonon region, but in maxon and roton region the influence is about 16% and 5%, respectively. The discrepancy with experimental data of all approximants in maxon and especially in roton region shows that the basis with one and two-phonon functions describes well only phonons in liquid ^{4}He. (21 refs.)

119292 Excitation spectrum of liquid He^4. K.M.Khanna (Dept. of Materials Sci., Nat. Inst. of Foundry & Forge Technol., Ranchi, India).
Indian J. Cryog., vol.8, no.2, p.97-8 (1983).
Energy excitation spectrum for liquid He^4 was calculated using the formalism containing the density fluctuation operator ρ_k and the velocity operator V_k. The interaction potential was the Morse potential. The theoretical and experimental E_k did not agree because of the absence of the long tail in the square well attractive potential used in the calculations. Calculations were done using the Gaussian potentials and the results are in very good agreement with the experimental results. (5 refs.)

119293 About the nonlinear fluctuation-dissipation theorem for plasmas in two and three dimensions. D.X.Lu (Dept. of Phys., Northeastern Univ., Boston, MA, USA), K.I.Golden.
Phys. Lett. A (Netherlands), vol.97A, no.9, p.391-4 (26 Sept. 1983).
The authors establish for the first time the fundamental nonlinear fluctuation-dissipation theorem for classical electron films trapped on liquid helium surfaces. When formulated in a reduced polarizability language, this theorem becomes identical to its three dimensional counterpart. (7 refs.)

119294 Third sound and energy dispersion of helium films. A.Isihara (Dept. of Phys. & Astron., State Univ. of New York, Buffalo, NY, USA), Chung-In Um, Woo-Hyung Kahng, Hee-Gyun Oh, Soon-Tahk Choh.
Phys. Rev. B (USA), vol.28, no.5, p.2509-15 (1 Sept. 1983).
Adopting a soft potential the authors have made a microscopic approach to the velocity of third sound in liquid ^{4}He films and derived an explicit formula for its temperature variation. This formula explains the temperature dependence of third sound without ad hoc assumptions such as those used by Rutledge, McMillan, Mochel, and Washburn. In particular, the source of the temperature dependence of the coefficient to the T^3 term which resulted from their approach is naturally explained. (10 refs.)

67.50 FERMI FLUIDS; LIQUID HELIUM-3

119295 Analytic vortices and magnetic resonances in rotating superfluid ^{3}He-*A*. II. K.Maki (Dept. of Phys., Univ. of Southern California, Los Angeles, CA, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2452-4 (1 Sept. 1983).
The earlier analysis of the vortex lattices in rotating ^{3}He-*A* is extended to lower temperatures. It is shown that, contrary to the earlier assertion, the observed satellite frequencies lie in between those associated with the circular and the hyperbolic vortices when the temperature-dependent corrections are properly included. Therefore, the author concludes that the vortex lattice of the circular-hyperbolic type is indeed realised in the Helsinki experiment. (9 refs.)

119296 Excitations in normal liquid ^{3}He. K.N.Pathak (Dept. of Phys., Panjab Univ., Punjab, India), M.Lucke.
Phys. Rev. B (USA), vol.28, no.5, p.2468-76 (1 Sept. 1983).
The dynamical density and spin-density response functions are expressed within a dispersion-relation representation in terms of the corresponding static susceptibilities and relaxation kernels. The kernels are approximated by two-mode decay processes. The resulting coupled integral equations are solved to get self-consistent spectral functions of the density and spin-density response. It is found that a density mode can decay into two density modes and two spin-fluctuation excitations whereas a spin-density fluctuation decays only into a density mode and a spin-density excitation. The theory predicts a well-defined zero-sound mode. The calculated excitation spectra of zero sound and spin-fluctuation excitations and their strengths are compared with neutron-scattering results. (25 refs.)

67.60 MIXED SYSTEMS; LIQUID HELIUM 3-4 MIXTURES

119297 Thermodynamic derivatives in ^{3}He-^{4}He mixtures in the critical region of the superfluid transition. A.Onuki (Res. Inst. for Fundamental Phys., Kyoto Univ., Kyoto, Japan).
J. Low Temp. Phys. (USA), vol.53, no.1-2, p.1-22 (Oct. 1983).
By assuming a phenomenological Ginzburg-Landau-Wilson free energy for ^{3}He-^{4}He mixtures near the critical surface of the superfluid transition the author can express thermodynamic derivatives of the form $(\partial a/\partial b)_{c,d}$ in terms of a correlation function of $|\psi|^2$, where ψ is the order parameter. Here a, b, c, and d are any four of the quantities entropy s, number density n, molar concentration X, temperature T, pressure p, and chemical potential difference $\Delta=\mu_3-\mu_4$. Relationships among these thermodynamic derivatives are those of the Pippard-Buckingham-Fairbank approximation in the ^{3}He-^{4}He case. Some combinations of the coefficients in the free energy are equal to derivatives on the critical surface and remain invariant with respect to renormalisation group transformations. A general scheme is also developed to give correlation function expressions for thermodynamic derivatives. (10 refs.)

119298 Convective instability of a superfluid ^{3}He-^{4}He mixture in a superleak. V.Steinberg (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA).
J. Low Temp. Phys. (USA), vol.53, no.1-2, p.177-87 (Oct. 1983).
The convective instability of a superfluid ^{3}He-^{4}He mixture in a porous medium confined between parallel horizontal planes is studied. It is shown that this system behaves as a pure classical liquid in a porous medium from the point of view of the convective instability in the whole range of the phase diagram between the λ line and the coexistence curve. It is predicted that two-fluid effects become important for the convection onset and can be observed experimentally in this system at moderately low temperatures. This system is supposed to be the most convenient one to study experimentally convection in a porous medium. (16 refs.)

119299 Critical and tricritical dynamics in ^{3}He-^{4}He mixtures. A.Onuki (Res. Inst. for Fundamental Phys., Kyoto Univ., Kyoto, Japan).
J. Low Temp. Phys. (USA), vol.53, no.1-2, p.189-220 (Oct. 1983).
A new formalism is presented to study the critical and tricritical dynamics of ^{3}He-^{4}He mixtures near the superfluid transition for arbitrary concentration. In this fluid two conserved variables, the molar concentration X and the entropy s, are twofold coupled to a complex order parameter ψ first in the dynamic equations reversibly and second in the free energy dissipatively. However, at an intermediate concentration $X=X_D$ (which is 0.37 at the saturated vapor pressure) a linear combination of X and s is found to be asymptotically decoupled from ψ both reversibly and dissipatively. There, dynamic renormalization group equations reduce to those of pure ^{4}He (or those of the F model) and some dynamic properties are common to those of pure ^{4}He. For example, at $X\approx X_D$, the gradient $\nabla(T-T_\lambda)$ under heat flow goes to zero without ^{3}He mass flow, where T_λ is the critical temperature, dependent on X, and the thermodiffusion ratio loses the singularity with the critical exponent α. The dynamic renormalization group equations take into account the above two nonlinear couplings and can be used for any concentrations. Furthermore, using a linear response scheme, general relations are obtained among the kinetic coefficients. As a result the thermal conductivity on the λ line is found to be exactly proportional to X^{-1} at small X. The coefficient in front of X^{-1} can be expressed in terms of the diffusion constants of an isolated ^{3}He molecule in ^{4}He. (47 refs.)

119300 Vortex motion and mutual friction in ^{3}He-^{4}He mixtures in the critical and tricritical regions. A.Onuki (Res. Inst. for Fundamental Phys., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.57-72 (July 1983).
The vortex motion is investigated under flow in ^{3}He-^{4}He mixtures near the λ line and near the tricritical point. Hall and Vinen's mutual friction parameters B and B' are found to diverge as $(T_\lambda-T)^{-1/3}$ at an intermediate molar concentration $X=X_D$ (which is 0.37 at saturated vapor pressure) as in pure ^{4}He. For other concentrations, however, they remain finite as $T\to T_\lambda$. The λ line value of B behaves as X^{-1} for $X\ll 1$ and as $(X-X_D)^{-2}$ for $X\simeq X_D$ whereas that of B' is 2. The point $X=X_D$ on the λ line is a singular point recently found by the present author. In the tricritical region B goes to zero as the inverse correlation length x and B' is very close to 2. There, a large concentration deviation is induced around a moving vortex line, giving rise to an enhanced resistance against the vortex line. As a unique feature in the tricritical region the vortex velocity must be nearly equal to the normal fluid velocity if the flow is sufficiently slowly-varying in time. (30 refs.)

67.70 FILMS

(inc. physical adsorption)

Third sound and energy dispersion of helium films ....See Entry 119294

67.80 SOLID HELIUM AND RELATED QUANTUM CRYSTALS

119301 Localization and quantum diffusion of He^3 atoms stimulated by phonons in He^4 crystals. V.A.Mikheev, V.A.Maidanov, N.P.Mikhin (Phys.-Tech. Inst. of Low Temperatures, Acad. of Sci., Kharkov, Ukrainian SSR).
Solid State Commun. (USA), vol.48, no.4, p.361-4 (Oct. 1983).
Using NMR technique the authors have measured the diffusion coefficient D of He^3 atoms in solid He^4 in a wide range of He^3 concentrations, densities and temperatures. It has been shown that in the low temperature plateau range D decreases sharply up to the values of $D\approx 3\times 10^{-12}$ cm^2 sec^{-1} when increasing concentration of He^3 up to 5%. The result obtained is indicative of the presence of strong localization of He^3 atoms in HCP phase of He^4 which is removed at the cost of quantum diffusion stimulated by phonons in full accordance with the theory predictions of Kagan (1981). The critical behaviour of D in the region of strong localization has been studied. The analysis of the contributions of different mechanisms to diffusion of He^3 has been made and this removes the available contradictions in the description of vacancy diffusion of He^3. For the first time the constant of dipole-dipole diffusion has been measured. (20 refs.)

68.00 SURFACES AND INTERFACES; THIN FILMS AND WHISKERS

(for impact phenomena, see 79.; for physics of crystal growth, see 61.50C; for corrosion, oxidation, and surface treatments, see 81.60)

68.10 FLUID SURFACES AND INTERFACES WITH FLUIDS

(inc. surface tension, capillarity, wetting and related phenomena)

119302 Acceleration of capillary impregnation by an external nonuniform electrical field. I.N.Karpovich, N.V.Churaev, M.S.Panchenko, A.L.Panasyuk (Dept. of Surface Phenomena, Acad. of Sci., Moscow, USSR).
Colloid J. USSR (USA), vol.44, no.6, p.920-6 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1044-50 (Nov.-Dec. 1982). [received: Sept. 1983]
It has been shown theoretically and experimentally that a nonuniform electrical field can have a substantial influence on the kinetics of liquid penetration into thin capillaries which represent a model of porous structures. The effect of the electrical field is most noticeable in the final stage of capillary impregnation. (9 refs.)

119303 Influence of additions of electrolytes and nonelectrolytes on the kinetics of the reduction of the surface tension of sodium alkylsulfate solutions. V.B.Fainerman, S.V.Lylyk (VINIPIchermetenergoochistka, Donetsk, Ukrainian SSR).
Colloid J. USSR (USA), vol.44, no.6, p.1001-9 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1141-50 (Nov.-Dec. 1982). [received: Sept. 1983]
The dynamic surface tension of aqueous solutions of sodium decyl, dodecyl, and tetradecyl sulfates without additives and with addition of various electrolytes and non-electrolytes was measured by the method of maximum pressure in a bubble in the range of surface life from 0.001 to 500 sec. The results obtained are evidence of the existence of a surface barrier to adsorption in these systems, which is due to a substantial degree to electrostatic interaction of the adsorbing and adsorbed surface-active ions and to hydrogen bonds in the surface layer of the solution. (25 refs.)

119304 Thermodynamic theory of the surface tension of liquids in homogeneous series of linear-chain molecules. V.M.Golubev (All-Union Res. Inst. for Synthetic Resins, Vladimir, USSR).
Colloid J. USSR (USA), vol.44, no.6, p.1020-4 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1162-5 (Nov.-Dec. 1982). [received: Sept. 1983]
On the basis of ideas of a polymeric liquid as a quasisolution of end-groups in a medium of elementary links of long-chain molecules, an examination is made of the equilibrium in a two-phase liquid-vapor system with a planar rupture surface. Differential equations are derived for the dependence of the surface tension on the temperature, the pressure, and the chain length. A

comparison of the theoretical deduction with available experimental data indicates a positive adsorption of the end groups in the surface layer of a liquid linear polymer. (19 refs.)

119305 Thermodynamics of the adhesion of bubbles and drops in presence of a film. V.D.Samygin (Moscow Steel & Alloys Inst., Moscow, USSR).
Colloid J. USSR (USA), vol.44, no.6, p.1054-6 (Nov.-Dec. 1982). Translation of. *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1193-5 (Nov.-Dec. 1982). [received: Sept. 1983]
A description is given of the phenomena of adhesion of bubbles and drops, based on the surface of a solid. (8 refs.)

119306 Heat of wetting of hydrophobic sites on a surface by water. M.V.Tovbin, E.P.Skorobagat'ko, G.G.Buderaskaya, L.V.Savchuk, E.N.Nikolaets (Kiev Univ., Kiev, Ukrainian SSR).
Colloid J. USSR (USA), vol.44, no.6, p.1061-3 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1199-201 (Nov.-Dec. 1982). [received: Sept. 1983]
It has been established experimentally that the forced flow of water onto hydrophobic sites on a PbI_2 surface is an endothermic process. (8 refs.)

119307 Electro-optical device for surface and interface tension measurement. P.Baglioni (Istituto di Chimica Fisica, Univ. di Firenze, Firenze, Italy), F.Francini, G.Gabrielle, G.Longobardi.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.478-81 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A description is given of a high resolution electro-optical device that supplies, in real time, values of surface tension of a drop of macromolecular substances as a function of time up to the equilibrium (pendant drop method). The optical system has a high magnification and high free working distance; the detection system consists of an optical scanner and a self scanned device. The application to automated drop inspection is discussed in relation to the other form of inspection systems. (5 refs.)

119308 A transfer matrix approach to the 3D wetting and pinning problems. J.M.Luck, S.Leibler, B.Derrida (Service de Phys. Theorique, CENS, Gif-sur-Yvette, France).
J. Phys. (France), vol.44, no.10, p.1135-42 (Oct. 1983).
The authors consider the pinning of an interface on a 3D lattice by an edge potential (semi-infinite geometry). This situation models the wetting transition occurring in such physical systems as binary fluids or adsorbed gases. The transfer matrix method is used to get exact results on strips of finite width; they propose a way of extrapolating them and of deriving the phase diagram of the infinite system. The mechanism of the transition changes when the pinning and roughening temperatures coincide. (19 refs.)

119309 Study of adsorption and solid-liquid interfacial tension of zinc-based ternary systems. C.Vahlas, N.Eustathopoulos (Lab. de Thermodynamique et Phys.-Chimie Metall., Domaine Univ., Saint Martin d'Heres, France).
J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.6, p.515-21 (June 1983). In French.
The interfacial tension of solid zinc in equilibrium with Bi, Cd and Pb, Sn liquid alloys has been measured using the 'dihedral angle method'. The interface enrichment factor of Cd and of Sn has been calculated from experimental results and the Gibbs adsorption equation. Tin segregates to solid Zn-liquid Pb interface, and leads to an important decrease in the interfacial tension. On the other hand, cadmium is not tensioactive at the interface solid Zn-liquid Bi, and the small variations of the interfacial tension with composition in this system Zn Bi Cd are only due to volume effects. The free energy of adsorption at infinite dilution of a C solute at the interface between solid A and liquid B has been evaluated with a simple thermodynamic model. These calculations and experimental results are in fairly good agreement. (23 refs.)

119310 The surface tension of liquid lead. A.Passerone, R.Sangiorgi, G.Caracciolo (Istituto di Chimica Fisica Applicata dei Materiali, CNR, Genova, Italy).
J. Chem. Thermodyn. (GB), vol.15, no.10, p.971-83 (Oct. 1983).
The liquid-vapour surface tension γ of lead has been determined by the sessile-drop method, under different physicochemical conditions, in the range 600.5 to 1150K. There has been found, on graphite and alumina supports: $\gamma/(\mathrm{mN.m^{-1}})=(444.2\pm1.0)\text{-}(9.4\pm0.3)\times10^{-2}(T\text{-}T_f)/\mathrm{K}$. Oxygen does not appear to have a measurable influence on the surface tension of lead, even under saturation of the liquid phase. (52 refs.)

119311 Surface chemistry of polyacetylene. A.Guiseppi-Elli, G.E.Wnek (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.159-62 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Explores the value of polyacetylene as an electrode material in aqueous media. The authors report on the determination of wettability and surface energy characteristics of pristine, iodine-doped and surface functionalized $(CH)_x$ and on the ion transport properties through $(CH)_x$ membranes. (10 refs.)

119312 Dynamic light scattering of surface fluctuations of a nematic liquid crystal. L.B.Shih, J.A.Mann, G.H.Brown (Liquid Crystal Inst., Kent State Univ., Kent, OH, USA).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.47-60 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The autocorrelation function of small amplitude capillary ripples was studied as a function of temperature for para-azoxyanisole (PAA). Measurements were carried out in the temperature range of 125°-148°C with the transition temperature observed to be 135°C. The authors report results for the case of $q=252.0\ \mathrm{cm^{-1}}$. The spectra of the autocorrelation functions were fit by Lorentzian models to yield the surface tension as a function of temperature. Several 'temperature jump' measurements were made wherein the current to the heaters was changed so that the equilibrium temperature at T_0 was perturbed slightly. Correlation functions were determined as the temperature increased to a new equilibrium state. Large shifts in frequency and time damping of the autocorrelation function were observed only when the temperature jump spanned the nematic-isotropic transition temperature. Equilibrium surface tension numbers are reported. The theory and practice for the light scattering measurement are outlined briefly. (20 refs.)

119313 Absence of critical wetting in systems with long-range forces. M.P.Nightingale (Dept. of Phys., Univ. of Washington, Seattle, WA, USA), W.F.Saam, M.Schick.
Phys. Rev. Lett. (USA), vol.51, no.14, p.1275-8 (3 Oct. 1983).
Study of a solid-on-solid model within the Migdal approximation leads the authors to conclude that the phenomenon of critical wetting cannot occur in the presence of long range, van der Waals forces. (19 refs.)

119314 Survey of extant data for the surface tension of iron and its binary alloys. B.J.Keene.
Report NPL-DMA(A)-67, Nat. Phys. Lab., Teddington, England (June 1983), i+116 pp.
The two principal parameters which influence the surface tension of a liquid metal are the melt composition and temperature. A knowledge of the influence of these two variables is important both in understanding the fundamental aspects of liquid metal structures and in ensuring the technological success of some major industrial processes. This review covers extant data on the surface tension of pure iron and binary iron alloys (Fe+Al, Fe+Sb, Fe+As, Fe+B, Fe+C, Fe+Cr, Fe+Co, Fe+Cu, Fe+Ga, Fe+Ge, Fe+H, Fe+Mn, Fe+Mo, Fe+Ni, Fe+N, Fe+O, Fe+P, Fe+Pd, Fe+Pt, Fe+rare earth metals, Fe+Rh, Fe+Se, Fe+Si, Fe+S, Fe+Te, Fe+Sn, Fe+Ti, Fe+W, Fe+V, Fe+Zr). Also included in this review are surface adsorption data and the suggested surface structures based upon them. For convenience, values of surface tension are expressed throughout in modified S.I. units ($\mathrm{mN.m^{-1}}$), which permit direct comparison with the numerically equal dyne $\mathrm{cm^{-1}}$ units of the obsolete c.g.s. system. (170 refs.)

Interaction between light beams in thermocapillary liquid media .... See Entry 118233

Thermodynamics of cavity formation in water: a molecular dynamics study .... See Entry 118847

Liquid crystal orientation on inorganic surfaces .... See Entry 118872

Theory of nucleation on charged cores. II. Thermodynamic parameters of an equilibrium nucleus .... See Entry 119149

Phase transitions of binary mixtures in random media .... See Entry 119155

The kinetics of adsorption of surface active agents at gas-liquid surfaces .... See Entry 119330

68.15 LIQUID THIN FILMS

119315 Disentanglement of hydrophobic and electrostatic contributions to the film pressures of ionic surfactants. A.L.Nichols,III, L.R.Pratt (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
Faraday Symp. Chem. Soc. (GB), no.17, p.129-40 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
The theory of electrolyte solution surfaces is extended to treat ionic surfactants spread on hydrocarbon-water interfaces. The object is to study the interplay between hydrophobic and electrostatic interactions responsible for micelle and membrane formation. Considerable attention is given to developing the theory in a reliable way so that hydrophobic effects can be reliably inferred by comparison with measured film pressures of ionic surfactants. The theory so constructed turns out to be remarkably sensitive to molecular-scale features of the interfacial region, particularly to the nature of water penetration behind the ionic head groups. The theory which assumes negligible water penetration provides a reasonable qualitative, but quantitatively deficient, description of the available experimental data for film pressures of sodium decylsulphate and sodium dodecylsulphate. After the cause of this behaviour is traced to the degree of water penetration permitted in the treatment, the authors adopt a heuristic modification of the result which compensates for the assumed neglect of water penetration. The resulting formulae provide an excellent quantitative description of the experimental film-pressure data. However, the heuristic nature of the result indicates that a considerably deeper molecular understanding of the short-ranged structure of these interfaces will be required before a conclusive picture can be presented. (34 refs.)

119316 Depinning and wetting transitions in one and two dimensions. S.T.Chui (Bartol Res. Found., Univ. of Delaware, Newark, DE, USA), K.B.Ma.
Phys. Rev. B (USA), vol.28, no.5, p.2555-60 (1 Sept. 1983).
Possible phase transitions and the critical properties of liquid films on top of substrates are discussed. The authors' ideas seem to explain a disagreement with mean-field theory in a recent experiment by Kwon et al. Connection with models in the context of instantons is pointed out. (27 refs.)

68.20 SOLID SURFACE STRUCTURE

119317 Temperature dependence of the sodium concentration over the sodium tungsten bronze ($Na_{0.79}WO_3$) surface studied by LEED. H.Nakamatsu, Y.Yamamoto, S.Kawai, K.Oura, T.Hanawa (Inst. of Sci. & Industrial Res., Osaka Univ., Osaka, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L461-3 (July 1983).
Temperature dependence of the LEED intensity of a tungsten bronze $Na_{0.79}WO_3$ (001) surface shows that the sodium concentration in the subsurface region increased as the temperature rises, while that at the topmost surface was kept constant in the (2×1) ordered phase. (14 refs.)

119318 Structure analysis of Ir(100) 1×1 by LEED (100-500 eV). G.Besold, K.Heinz, E.Lang, K.Muller (Inst. fur Angewandte Phys., Univ. Erlangen-Nurnberg, Erlangen, Germany).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1473-6 (1983).
LEED intensity measurements and dynamical calculations have been performed for the nonreconstructed Ir(100) surface. They were compared with each other using the Zanazzi-Jona factor for different energy ranges of the spectra, i.e. 100-250, 250-500, and 100-500 eV. It turns out that the surface relaxation is always nearly the same, at least within the error of the fit, $\Delta d/d=-2\%\pm2\%$. However, it appears that the r factors are definitely lower for the high energy region accompanied by a slight increase of the precision with which $\Delta d/d$ can be extracted. The Zanazzi-Jona factor of the total energy range cannot be interpreted as a linearly weighted average of these of the subranges. (14 refs.)

119319 Faceting of a Ge(111) surface and its vicinals during Ag adsorption. E.Suliga, M.Henzler (Inst. fur Festkorperphys., Univ. Hannover, Hannover, Germany).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1507-11 (1983).
The stability of a Ge(111) surface and its vicinals were studied by LEED for clean and Ag covered conditions. Before deposition the surfaces were macroscopically smooth. After deposition of only a few tenths of a monolayer of Ag and heating to 400°C, the surface consisted of narrow (544) facet planes and wide (111) terraces. At coverage above 0.7 the (544) facets disappeared and (211) facets started growing. The facets had dimensions in the range of 10 μ, so that they could be observed with an optical microscope. Furthermore, a rotation of ledges into directions with low indices was observed. The results show that the equilibrium shape of a surface is drastically changed by a coverage of a fraction of a monolayer due to the formation of new minima of the surface free energy at peculiar high index vicinal surfaces. (15 refs.)

119320 Surface reconstruction in crystals. D.B.Abraham (Dept. of Theoretical Chem., Univ. of Oxford, Oxford, England).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1279-81 (3 Oct. 1983).
A model is proposed which shows both a surface-reconstructive phase transition and a faceting transition, depending on the molecular parameters. It involves a further generalization of Lieb's six-vertex problem. (14 refs.)

119321 Physical origin of surface segregation in binary alloys. Yi-Chen Cheng (Dept. of Phys., Nat. Taiwan Univ., Taipei, Taiwan).
Phys. Rev. B (USA), vol.28, no.6, p.2937-9 (15 Sept. 1983).
Mill's theory of surface effects on a magnetic system is applied to the surface segregation phenomenon in binary alloys. The effect of lattice strain energy is not considered. It is shown that there are two driving forces for the surface segregation: (1) the difference in the surface energy of the composing elements, and (2) a collective effect depending on the relative concentration only. The former force predicts that the element with lower surface energy is enriched on the surface, while the latter force predicts an enrichment of the minority element on the surface. The above results are restricted to the alloys with positive heat of mixing and at a temperature higher than the bulk critical temperature. (18 refs.)

119322 Alkali metal-induced reconstruction of Ag(110). B.E.Hayden, K.C.Prince, P.J.Davie, G.Paolucci, A.M.Bradshaw (Fritz-Haber-Inst., Max-Planck-Gesellschaft, Berlin, Germany).
Solid State Commun. (USA), vol.48, no.4, p.325-8 (Oct. 1983).
The adsorption of Li, K and Cs on the Ag(110) surface has been studied by LEED, AES and work function measurements. It was found that adsorption of small amounts of the three alkalis studied ($0.05<\theta<0.2$) induces a (1×2) reconstruction of the Ag(110) surface at 300K. The authors suggest that a redistribution of the alkali-induced increase in the density of states at E_F drives the surface phase transition via surface phonon softening. Similar behaviour observed on Cu(110) may indicate that alkali-induced reconstruction is a general phenomenon. (23 refs.)

119323 Evidence for 2×1 building block in the atomic structure of Si ⟨111⟩ 7×7. W.S.Yang, F.Jona (Dept. of Merials Sci. & Engng., Ste Univ. of New York, Stony Brook, NY, USA).
Solid State Commun. (USA), vol.48, no.4, p.377-9 (Oct. 1983).
The well known experimental Si ⟨111⟩ 7×7 LEED pattern is shown to exhibit systematic enhancement of diffracted intensity at the $^1/_2$-order positions, thus revealing the existence of 2×1 or 2×2 structural components in the 7×7 structure. comparison of experimental LEED spectra from the 7×7 structure with a single-domain Si 111 2×1 cleaved structure reveals remarkable similarities. The conclusion is that the fundamental building block of the 7×7 structure is a 2×1 subunit which closely resembles the unit cell of the cleaved 2×1 structure. (11 refs.)

119324 The change in the composition and structure of glass surface during the interaction with salt melts. I.M.Bushueva, S.R.Sergeeva, I.N.Kurbatova, T.L.Konovalova.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.55-8 (Aug. 1983). In Russian.
The electrode behavior of glasses has been investigated in salt melts. Concentration profiles of the distribution of Na, K, Ca ions and SiO_2 in glass interacting with melts of KNO_3 and KNO_3-$Ca(NO_3)_2$ are discussed. (4 refs.)

Thermal microscopes .... See Entry 117170

Extended appearance-potential fine-structure analysis of Fe (110) surface .... See Entry 120193

Low-energy electron energy-loss spectra associated with reconstructed structure on Si (111) surface .... See Entry 120198

Modification of the surface due to ion bombardment: an XPS study .... See Entry 120204

Core-level photoelectron spectroscopy of surfaces and adsorbates .... See Entry 120215

Characterization of thin Nb_3Sn diffusion layers on Nb (110): low-energy electron-diffraction and photoemission studies .... See Entry 120220

Exoemission method for detection of an insulating layer on the surface of a ferroelectric .... See Entry 120227

Study of cleaved, oxidized, and heat-treated CdTe surfaces ...See Entry 120461

Surface topography of oxides on InP thermally grown at high temperatures .... See Entry 120462

Status report on ASTM E-42 Committee on surface analysis .... See Entry 120697

68.25 MECHANICAL AND ACOUSTICAL PROPERTIES OF SOLID SURFACES AND INTERFACES

(for tribology, see 62.20P and 81.40P)

119325 Propagation and amplification of surface waves in a thermopiezosemiconducting medium. A.K.Pal (Dept. of Math., Jadavpur Univ., Calcutta, India).
Acta Phys. Pol. A (Poland), vol.A64, no.3, p.323-34 (Sept. 1983).
The problem of propagation and amplification of surface waves has been studied in a hexagonal piezoelectric medium which is also semiconducting in nature. It is well known that in addition to the piezosemiconducting properties these materials also possess the pyroelectric property. So in order to consider the most realistic situation, the present investigation takes into account the triple coupling between electrical, mechanical and thermal fields by linearizing the non-linear equations under small signal assumptions as it has been done in the paper by Hutson and White (1962). Expressions for the piezoelectric Poynting vector and the components of the power flow in the surface wave have also been derived in order to give to the problem its complete shape. (16 refs.)

119326 surface acoustic wave properties of thin film CdS prepared by hot wall technology. H.J.Rohde, H.J.Frohlich (Akad. der Wissenschaften, Zentralinst. fur Elektronenphys., Berlin, Germany).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.5-6, p.343-50 (1983).
Piezoelectric CdS thin films are prepared by vapour deposition using the hot wall technique. Optimum performance regarding their application to interdigital transducers of surface acoustic waves is obtained by a substrate temperature of 470K, a hot wall temperature 670K and rate of deposition=3 μm/h. Measurements of a RF voltage ratio in a simple circuit containing samples of CdS thin films deposited on top of interdigital structures allows calculation of electromechanical coupling coefficients. Values as high as 80% of the theoretical ones are obtained. (8 refs.)

119327 Diagnostics of the elastic properties of quartz and glass surfaces during ion implantation. I.I.Daugela, S.A.Ionyalyunas, L.I.Pranyavichyus (Antanas Snechkus Polytech. Inst., Kaunas, USSR).
Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.572-3 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1327-9 (Nov. 1982). [received: Sept. 1983]
The authors have used an acoustic method to study the elastic properties of the surface layers of single crystals of quartz and K-8 glass during the implantation of He^+ and Ar^+ ions. This acoustic method, which involves detecting the relative change $\Delta v_R/v_R$ in the propagation velocity of surface acoustic waves in the ion-bombarded material, has the advantages that it is nondestructive, accurate, and usable directly during the ion implantation (in situ). The relative change in the SAW propagation velocity was measured with a SAW delay line made from the material being studied. In the case of the glass, the SAWs were excited and detected by thin-film transducers made from piezoelectric zinc oxide films. (3 refs.)

119328 Examination of surface acoustic wave components using a scanning electron microscope. H.P.Feuerbaum, H.P.Grassl, U.Knauer, R.Veith (Forschungslab., Siemens AG, Munchen, Germany).
Scanning Electron Microsc. (USA), pt.1, p.55-63 (1983). (Scanning Electron Microscopy 1983 Conference, Dearborn, MI, USA, 17-22 April 1983).
Six methods have been used for the examination of surface acoustic wave components with a scanning electron microscope. Standing waves are visualized in the voltage contrast mode. Combined with stroboscopic techniques, the voltage contrast shows the propagation of travelling waves in detail. By a newly developed set-up the attenuation of travelling waves across a substrate can be measured. The application of these modes is demonstrated by the examination of SAW components on $LiNbO_3$. (13 refs.)

Surface Love waves in orthotropic regularly layered composites .... See Entry 118478

68.30 DYNAMICS OF SOLID SURFACES AND INTERFACE VIBRATIONS

119329 Relaxation effects in the vibrations of a lithium fluoride surface. E.R.Cowley, J.A.Barker (IBM Res. Lab., San Jose, CA, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3124-9 (15 Sept. 1983).
The vibrational frequencies of a 15-layer slab are calculated for a simple shell model of lithium fluoride, and the surface modes occurring are analyzed. The static relaxations of a slab and of a single surface are calculated for the same model, and the effects of the relaxation on the vibrational frequencies are investigated. A puckering distortion of the surface layer is incorporated in the vibrational calculations for the first time and is found in this case to introduce one extra surface mode. (15 refs.)

New high resolution electron spectrometer for surface vibrational analysis .... See Entry 117281

Alkali metal-induced reconstruction of Ag(110) .... See Entry 119322

Virtual surface plasmons in cylinders .... See Entry 119491

Time-resolved total internal reflection fluorescence spectroscopy of polymer films .... See Entry 120118

Double losses and overtones in electron-energy-loss studies of surface vibrations: the role of lateral interactions .... See Entry 120202

68.40 SURFACE ENERGY OF SOLIDS; THERMODYNAMIC PROPERTIES

Thermodynamics of the adhesion of bubbles and drops in presence of a film .... See Entry 119305

Faceting of a Ge(111) surface and its vicinals during Ag adsorption .... See Entry 119319

Physical origin of surface segregation in binary alloys .... See Entry 119321

Macroscopic fracture surface energy of unidirectional metal matrix composites: experiment and theory .... See Entry 120407

68.45 SOLID-FLUID INTERFACE PROCESSES

(see also 82.65 Sorption and accommodation coefficients)

119330 The kinetics of adsorption of surface active agents at gas-liquid surfaces. R.P.Borwankar, D.T.Wasan (Dept. of Chem. Engng., Illinois Inst. of Technol., Chicago, IL, USA).
Chem. Eng. Sci. (GB), vol.38, no.10, p.1637-49 (1983).
A general model of adsorption of surfactants at a gas-liquid surface has been developed, which accounts for both the diffusion in the bulk and the barrier to adsorption. In this model, the activation energy barrier to adsorption is accounted for by means of a kinetic expression. A numerical scheme for the solution of the resulting equation of the diffusion-kinetic model is illustrated for the case of the Frumkin isotherm. The model is used to estimate the extent of the adsorption barrier from the dynamic surface tension data of two aqueous surfactant systems reported in the literature. A simplification of the diffusion-kinetic model is proposed which accounts for diffusion in the bulk using diffusion-penetration theory. The simplified model compares very well with the exact model, especially for high barrier resistances. (33 refs.)

119331 Influence of molecular mass on the adsorption of oligobutadienes on oxidized carbon blacks. A.V.Kiselev, Yu.V.Malygin, V.N.Stroev, Yu.A.El'tekov (Inst. of Phys. Chem., Acad. of Sci., Moscow, USSR).
Colloid J. USSR (USA), vol.44, no.6, p.926-30 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1051-6 (Nov.-Dec. 1982). [received: Sept. 1983]
The adsorption of dilute solutions of narrow fractions of oligobutadienes with molecular masses of 500, 800, 2800, and 3000 in n-heptane has been studied on samples of PM-100 furnace carbon black, oxidized by air oxygen under various conditions. The conclusion has been reached that the size of the micropores of the adsorbents and the dimension of the oligomer molecules have a strong influence on the degree of adsorption. (9 refs.)

119332 Investigation of the sorption of stearic acid and its esters on steel. N.V.Volnyanskaya, O.S.Kas'yan (Inst. of Ferrous Metall., Dnepropetrovsk, Ukrainian SSR).
Colloid J. USSR (USA), vol.44, no.6, p.1016-20 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1158-62 (Nov.-Dec. 1982). [received: Sept. 1983]
A radiative tracer method and IR spectroscopy were used to study the sorption interaction of steel with solutions of stearic acid, distearin glycol ester, and butyl stearate in a hydrocarbon medium at 20-200°C. Stearic acid and distearin glycol ester were found to possess a strong tendency of forming

surface compounds; the amount formed was found to correspond to a polymolecular structure and to depend on the duration and temperature of interaction between metal and solution, the concentration of the solution, and that it could form up to 25-30 monolayers. The films obtained represent the intermediate stage in the formation of soaps, the final products of the surface reaction. (20 refs.)

119333 A cluster model method and its applications to chemisorptions on semiconductor surfaces. Zhang Kaiming, Xu Yongnian, Xie Xide (Modern Phys. Inst., Fudan Univ., Shanghai, China).
Commun. Theor. Phys. (China), vol.2, no.3, p.1065-73 (1983).
The cluster model and charge self-consistent method are used to study the chemisorptions on Si (111), Ge (111), and GaAs (110) surfaces. The parameters in the calculations are selected to fit the respective bulk energy bands of Si, Ge, and GaAs. Some general rules of chemisorptions on Si (111) and Ge (111) are investigated and speculated. The three-fold hollow site geometry is favorable for group III metals on Si (111), whereas the one-fold top site is more stable for group VII elements, the reason being probably one of the favorable charge distribution. However, the situation for chemisorptions on Ge (111) is somewhat different. The adsorptions of group III and V elements on GaAs (110) are also considered. The possible chemisorption geometries and the related electronic states for these systems are calculated and discussed. (30 refs.)

119334 Carbon segregation to the Pd(111) single crystal surface as seen in carbon monoxide thermal desorption spectra. I.Ratajczykowa (Inst. of Phys. Chem., Polish Acad. of Sci., Warszawa, Poland).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1512-17 (1983).
Carbon monoxide adsorption was studied on the Pd(111) surface with submonolayer carbon coverages. It is shown that carbon monoxide desorption spectrum can be used in the detection of a carbon coverage much below the detectability level of AES. Although the estimation of the absolute carbon coverage is subjected to quite a bit of uncertainty it seems that a few percent of a monolayer of carbon manifests clearly in the desorption spectrum at low carbon monoxide coverages. With the aid of CO desorption spectra the temperature dependence of the surface segregation of carbon was investigated at temperatures from 450 to 1300K with the mean C/Pd atomic ratio in the bulk ranging from 1×10^{-6} to 7×10^{-6}. At any temperature below 835K carbon does not appear on the surface. At higher temperatures carbon segregates at the surface very quickly and within a temperature range depending on the C/Pd ratio. Carbon that has been segregated on the surface can be easily redissolved even at temperatures as low as 450K. The behavior of carbon is explained in terms of formation and decomposition of the carbon-rich palladium phase $PdC_{0.13}$. Some implications for cleaning PD(111) crystals are also shortly discussed. (12 refs.)

119335 Effect of heat treatment on the structural characteristics and sorption properties of clinoptilolite. M.N.Kostandyan, S.G.Babayan, M.A.Balayan (All-Union Sci.-Res. Inst. of Chem. Reagents & Special-Purity Chem. Substances, USSR).
Inorg. Mater. (USA), vol.18, no.10, p.1498-501 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1743-6 (Oct. 1982). [received: Sept. 1983]
It was shown that the structural changes that occur during dehydration are due to the participation of water molecules in the energy balance of zeolite. The optimum temperature range of the thermoactivation of clinoptilolite was determined as 520-670K. (5 refs.)

119336 Kinetics of hydrogen absorption by α-zirconium. S.Naito (Inst. of Atomic Energy, Kyoto Univ., Kyoto, Japan).
J. Chem. Phys. (USA), vol.79, no.6, p.3113-20 (15 Sept. 1983).
The kinetics of hydrogen absorption by polycrystalline α-zirconium metals has been investigated by the use of spherical specimens in the pressure range 2×10^{-5}-1×10^{1} Pa and in the temperature range 673-1073K. The experimental results are reasonably explained on the basis of the model in which the process is assumed to be composed of three successive steps: dissociative adsorption with lateral interaction between adsorbed hydrogen atoms; jump of the absorbed hydrogen atom into the interstitial site; and finally its diffusion into the metal bulk. Both the first and third steps are rate controlling under the conditions of low pressures or low temperatures within the pressure and temperature ranges of this investigation. At low temperatures the absorption rate is significantly affected by the lateral interaction as the pressure is increased. Some parameters which charactrize the derived rate equations have been determined: the activation energies are $(1.7\pm0.5)\times10^{-21}$ J/H atom for dissociative adsorption and $(9.43\pm0.30)\times10^{-20}$ J/H atom for desorption, and the heat for jump is $(9.4\pm1.5)\times10^{-21}$ J/H atom. The lateral interaction is repulsive and its energy is $\sim4\times10^{-20}$ J/H atom for $0\leq\alpha\leq0.4$, where α represents the so-called transfer factor. (41 refs.)

119337 Ground state energy and structure of physisorbed monolayers of linear molecules. L.W.Bruch (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).
J. Chem. Phys. (USA), vol.79, no.6, p.3148-56 (15 Sept. 1983).
Model calculations of the ground state configuration and energy of monolayers of CO_2 and of N_2 adsorbed on the basal plane surface of graphite are reported. The interaction models consist of atom-atom and site-site potentials and point quadrupole moments, as in models for the three-dimensional bulk solids, supplemented by effects of static and dynamic screening of multipole fields by surface charges on the graphite. There is a good quantitative agreement with estimated zero temperature heats of adsorption for N_2/Gr and the calculated ground state configuration is the $\sqrt{3}$ R 30° registered monolayer solid. For CO_2/Gr, the calculated low coverage isosteric heat differs by 15% from the experimental value, but the calculated lateral energy of the monolayer solid is consistent with available experimental information. Within the uncertainty caused by this discrepancy, the calculations are consistent with a suggested that CO_2/Gr is a nonwetting system at low temperatures. The ground state configuration of monolayer CO_2/Gr is calculated to be an incommensurate solid of number density within 5% of the number density of the $\sqrt{3}$ R 30° solid. (38 refs.)

119338 The sorptivity of brick: dependence on the initial water content. C.Hall, W.D.Hoff, M.Skeldon (Dept. of Building, Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
J. Phys. D (GB), vol.16, no.10, p.1875-80 (14 Oct. 1983).
The water absorption sorptivity of brick ceramic falls as the initial water content rises. New results and reanalysed literature data are in agreement with unsaturated flow theory. The approximate formulae of Philip (1957) and of Brutsaert (1976) are compared with experimental data, establishing the value of the Brutsaert formulae. (17 refs.)

119339 A study of SO_2 adsorption on CaO (100) surfaces using X-ray photoelectron spectroscopy. C.D.Stinespring (Morgantown Energy Technol. Center, Morgantown, WV, USA), J.M.Cook.
J. Electron Spectrosc. & Relat. Phenom. (Netherlands), vol.32, no.2, p.113-22 (Sept. 1983).
The adsorption of SO_2 on CaO (100) at 300K has been studied using X-ray photoelectron spectroscopy. Under ultrahigh-vacuum conditions, the surface was exposed to 0-500 Langmuirs of SO_2. The resulting adsorption yields a single S-O surface species with an S $2p$ peak at 168.2 eV and an O $1s_{1/2}$ peak at 531.7 eV. Subsequent heating of the exposed surface to 673K indicated no desorption or changes in the binding energies of the S $2p$ and O $1s_{1/2}$ peaks. On the basis of these data and binding-energy data for standard compounds, the absorbed species is identified as SO_4^{2-}. The surface coverage due to the SO_4^{2-} species was also measured as a function of SO_2 exposure. From these data, the initial adsorption is found to be first-order in surface coverage, and the initial sticking probability is found to have a value of 0.4. (16 refs.)

119340 Heat capacity of diatomic molecules adsorbed on a periodic substrate and the localized-to-mobile transition. A.Milchev (Inst. of Phys. Chem., Bulgarian Acad. of Sci., Sofia, Bulgaria).
Phys. Status Solidi a (Germany), vol.79, no.1, p.301-8 (Sept. 1983).
Heat capacities and related thermodynamic functions of a system of isolated diatomic molecules adsorbed on a periodic substrate are calculated by means of classical statistical mechanics. It is shown that the thermal transition from localized-to-mobile behaviour of the system of dimers is clearly reflected by the characteristic shape of the specific heat vs. temperature curve. According to the present theoretical investigation the maximum in the specific heat curve marking the localized-to-mobile transition generally depends both on position and height on the values of the energy barriers W_x and W_y along the X- and Y-axes. For substrates with $W_x/W_y<1/4$ the single maximum splits into two maxima with different heights. Further, for a given substrate, one obtained qualitatively different specific heat curves (with a single or with two separate maxima) if adsorption of dimers with different length is considered. The physical backgrounds of the problem are elucidated in more detail in the case of 1D system. (7 refs.)

119341 Kinetics of ordering in two dimensions. I. Model systems. S.A.Safran, P.S.Sahni, G.S.Grest (Corporate Res. Sci. Labs., Exxon Res. & Engng. Co., Lieden, NJ, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2693-704 (1 Sept. 1983).
The approach to equilibrium of ordered superlattice structures on surfaces is analyzed. Both Monte Carlo methods as well as analytic models of interacting domain walls are used to study the kinetics of quenched, two-dimensional systems with Q degenerate equilibrium states. In particular, the growth of long-range order in the magnetic analogs (Q-component Potts models) of the commensurate superlattice structures found on surfaces is analyzed in a study of the kinetics of typical domain geometries that are found when systems are quenched from high (disordered states) to low temperatures. Calculations and simulations of the time and temperature dependence of the domain sizes for the model system of isolated domains indicate that for two dimensions roughening fluctuations of the domain walls strongly influence the grain growth kinetics. Strip-shaped domains approach equilibrium almost entirely through these fluctuations, while circular domains shrink due to deterministic curvature, but with a rate that is strongly temperature dependent even for temperatures outside the critical region. Pinning effects in systems with $Q\geq3$ lead to extremely slow kinetics for particular domain geometries. Low-temperature quenches on a triangular lattice indicate that these pinned geometries are rarely nucleated, while quenches on a square lattice equilibrate much more slowly due to pinning. The application of the theory to superlattice grain growth on surfaces are discussed in the following paper which presents results for the kinetics of quenched systems in terms of the simple domain geometries examined here. (34 refs.)

119342 Kinetics of ordering in two dimensions. II. Quenched systems. P.S.Sahni, D.J.Srolovitz, G.S.Grest, M.P.Anderson, S.A.Safran.
Phys. Rev. B (USA), vol.28, no.5, p.2705-16 (1 Sept. 1983).
For pt.I see ibid., vol.28, p.2693 (1983). An efficient Monte Carlo procedure is applied to the study of the kinetics of low-and high-Q Potts models on surfaces quenched from a high temperature ($T\gg T_c$) to low temperatures ($T<T_c$). The kinetics of these models are analyzed in simulations which yield the time dependence of the size and shape of the domains. After an initial transient period the mean domain size R increases with time as $R\sim t^n$. For the triangular lattice at all temperatures and for the square lattice at temperatures $T<0.5T_c$, the exponent n decreases from $^1/_2$ for $Q=2$ (Ising model) to approximately 0.41 for large Q. The distribution of grain sizes and shapes is also calculated from the results of the simulations. For large Q, these distributions are time independent. On the square lattice at low temperatures the growth exponent is approximately equal to 0, due to the nucleation of pinned domains. The Monte Carlo results are discussed in terms of experimental studies of the ordering of adsorbed atoms on surfaces and of the growth of grains in polycrystalline materials. (38 refs.)

119343 Phase transitions in monolayers adsorbed on uniaxial substrates. H.J.Schnulz (Inst. Laue-Langevin, Grenoble, France).
Phys. Rev. B (USA), vol.28, no.5, p.2746-9 (1 Sept. 1983).
The phase diagram of a $p\times1$ uniaxial adsorbed layer is investigated theoretically, including the possibility of incommensurate phases. For $p=3$ and 4 the author determines the incommensurability crossover exponents at the commensurate-fluid multicritical point. The author then argues that due to a strong renormalization of the dislocation core energy the incommensurate phase should be stable up to the multicritical point for$p\geq3$. Possible phase diagrams for general p are discussed. (29 refs.)

119344 Shape of physical adsorption potentials. G.Vidali, M.W.Cole (Dept. of Phys., California Inst. of Technol., Pasadena, CA, USA), J.R.Klein.
Phys. Rev. B (USA), vol.28, no.6, p.3064-73 (15 Sept. 1983).
The possibility is considered that all physical adsorption potentials have the same shape. Evidence is collected from experiments (atomic scattering, low-energy electron diffraction, thermodynamics) and theory. New calculations are performed for He and Ar interacting with an Ar solid. The assembled information indicates that the shapes are, indeed, very similar. The length scale is found to be $l=(C_3/D)^{1/3}$, where D is the well depth and C_3 is the coefficient of the dispersion force. It appears that alkali halide surfaces provide a softer reduced repulsion than other systems; this is tentatively interpreted in terms of an induced dipole attraction. Comparison is made with other universal potential functions and with a simple model based on overlap with substrate charge density. (78 refs.)

119345 All-electron local-density theory of alkali-metal bonding on transition-metal surfaces: Cs on W(001). E.Wimmer, A.J.Freeman (Materials Res. Center & Phys. Dept., Northwestern Univ., Evanston, IL, USA), J.R.Hiskes, A.M.Karo.
Phys. Rev. B (USA), vol.28, no.6, p.3074-91 (15 Sept. 1983).
A theoretical study of the nature and the mechanism of the bonding of an alkali metal (Cs) on a transition-metal surface [W(001)] in the high-coverage limit is presented in order to understand and explain the lowering of the work function and to elucidate the role of W surface states and surface resonance states in the adsorption process. The analysis is based on all-electron local-density-functional results obtained with the authors' self-consistent full-potential linearized augmented-plane-wave method for thin films for (1) a five-layer slab of W, (2) an unsupported Cs monolayer, and (3) Cs in a $c(2 \times 2)$ structure on both sides of the five-layer W slab for three different Cs-W separations. They find that Cs forms a polarized-metallic rather than ionic overlayer: The Cs valence electrons originating from the atomic 6*s* states are polarized toward the W surface leading to an increase of electronic charge in the Cs/W interface region and a depletion of electronic charge on the vacuum side of the overlayer. In addition, the semicore Cs 5*p* electrons are markedly counterpolarized. The net result of these multiple surface dipoles is a lowering of the work function upon cesiation from 4.77 eV (clean five-layer W slab) to 2.77, 2.55, and 2.28 eV, corresponding to heights of the Cs atoms above the W surface of 2.60, 2.75, and 2.90 Å, respectively. The Cs-induced changes in the charge density are essentially localized outside the surface W atoms. The W *d* surface states and surface resonance states which are so characteristic of the W(001) surface are found to persist on the cesiated W(001) surface. The main effect of the Cs overlayer on these states is their energetic stabilization; this effect is most pronounced for the contamination-sensitive Γ_1 surface state just below the Fermi energy, which is lowered in energy by 1 eV due to hybridization with Cs *s* states. (135 refs.)

119346 Domain-growth kinetics of herringbone phases. O.G.Mouritsen (Dept. of Phys. Chem., Aarhus Univ., Aarhus, Denmark).
Phys. Rev. B (USA), vol.28, no.6, p.3150-2 (15 Sept. 1983).
The growth of two-dimensional herringbone phases following quenches from high to low temperatures is analyzed by computer simulation. The herringbone ordering is threefold degenerate and governed by an anisotropic-planar rotor model on a triangular lattice. The model describes the orientational properties of N_2 on graphite. The growth with time of the average domain radius is shown to be algebraic with a rather low growth exponent $n \simeq 0.25$. (24 refs.)

119347 Intrinsic defects of TiO_2 (110): Interaction with chemisorbed O_2, H_2, CO, and CO_2. W.Gopel, G.Rocker (Phys. Dept., Montana State Univ., Bozeman, MT, USA), R.Feirabend.
Phys. Rev. B (USA), vol.28, no.6, p.3427-38 (15 Sept. 1983).
The interaction of TiO_2 (110) with O_2, H_2, CO and CO_2 was studied by means of low-energy electron diffraction, X-ray photoelectron spectroscopy, electron energy-loss spectroscopy, thermal desorption, electron paramagnetic resonance, and measurements of changes in surface conductivities $\Delta\sigma$, and work functions, $\Delta\phi$, for $300 \leq T \leq 1000$K with particular emphasis on surface reactions involving intrinsic surface defects $2Ti^{3+}.V_O^{(+)}$. The defects are thermodynamically stable at high temperatures and act as donors and specific absorption sites for H_2 and CO. Surface and subsurface reactions involving O_2, H_2, CO, and CO_2 can be separated from each other by analyzing the $\Delta\sigma$ and $\Delta\phi$ effects in a charge-transfer model, which takes into account surface and bulk electronic states in the band gap attributed to the different defects formed during the interaction. (37 refs.)

119348 Effect of cluster size on the electronic properties of a chemisorption system. S.K.Saha, B.C.Khanra (Solid State & Molecular Phys. Div., Saha Inst. of Nuclear Phys., Calcutta, India).
Solid State Commun. (USA), vol.48, no.2, p.155-8 (Oct. 1983).
Tight binding cluster Bethe lattice model has been used to study the electronic properties of a chemisorption system for various sizes of substrate-atom clusters. For a single-orbital adsorbate on a simple cubic tight binding solid it has been shown that the chemisorption energy converges for a cluster consisting of the first and second nearest neighbours of the adsorbate. (10 refs.)

119349 Correlation function of large-period adatom lattices. I.F.Lyuksyutov (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-JETP (USA), vol.56, no.6, p.1321-4 (Dec. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.6, p.2281-6 (Dec. 1982). [received: Oct. 1983]
An investigation is made of the correlation properties of large-period structures. It is shown that a Berezinskii phase, which is characterized by power-law decay of the correlations, can exist in such structures at temperatures $T > T_p$. Transition to this phase from one with an ordinary long-range order is isomorphous with a phase transition in a two-dimensional plasma. Therefore, in the static limit, in spite of the potential relief of the substrate which is considerably greater than the interaction between adatoms, the behavior of large-period structures at temperatures $T > T_p$ is equivalent to the behaviour of a crystal on a smooth substrate. (17 refs.)

119350 Phase transitions in adsorbed films. I.F.Lyuksyutov.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1281-303 (Sept. 1983). In Russian.
A review of theoretical models of phase transitions on surfaces is presented. Different types of phase transitions—from the long-range order phase to the disordered phase and to the quasi-long range order phase, commensurate-incommensurate crystal phase, two-dimensional melting, etc.—are discussed. Examples of modern experimental studies in surface phase transitions are considered. (55 refs.)

119351 Ellipsometric investigation of cerium (III) cation adsorption on the platinum electrode in sulfuric acid solution. I.A.Vinokurov, V.I.Kravtsov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.106-7 (Aug. 1983). In Russian.
It is shown ellipsometrically that cerium (III) and cerium (IV) are not adsorbed on the platinum electrode at potentials 0.45-1.60 V. (9 refs.)

119352 Surface diffusion of iodide ions chemisorbed on silver. E.A.Daniels, M.Y.Pandit (Dept. of Chem., Univ. of Poona, Pune, India).
Z. Phys. Chem., Wiesbaden (Germany), vol.133, no.2, p.215-28 (1982). [received: Oct. 1983]
Phenomena of surface diffusion and surface self-diffusion of I^- adions on polycrystalline silver are studied by a radiotracer technique. At a given temperature the diffusion coefficient measured for surface coverages extending up to monolayer increased with increasing coverage. At fixed temperature and surface coverage the coefficient of surface diffusion is slightly greater than that of surface self-diffusion. The two types of diffusion phenomena are considered in the light of accompanying entropy changes as well as the surface spreading forces involved. (25 refs.)

Finite-size-scaling study of a two-dimensional lattice-gas model with a tricritical point ....See Entry 117115

Separation of bulk and surface light absorption with an open photoacoustic cell ....See Entry 117250

Comparison of photon-stimulated dissociation of gas-phase, solid and chemisorbed water ....See Entry 117942

Excuded volume effects in polymers attached to surfaces: chain conformational renormalization group ....See Entry 118018

Study of adsorption and solid-liquid interfacial tension of zinc-based ternary systems ....See Entry 119309

Faceting of a Ge(111) surface and its vicinals during Ag adsorption ....See Entry 119319

Alkali metal-induced reconstruction of Ag(110) ....See Entry 119322

The change in the composition and structure of glass surface during the interaction with salt melts ....See Entry 119324

Ionic limit in graphite-fluoroarsenate intercalation compounds ....See Entry 119538

A study of valence band shake-up features of CO on Pt{100} using synchrotron radiation ....See Entry 119679

Electronic structure of metal overlayers on rhodium ....See Entry 119683

Electronic structure of transition-metal—transition-metal interfaces: Pd on Nb(110) ....See Entry 119684

Interaction of CO and N_2 with the Cu (111) surface ....See Entry 119685

ESR study of oxygen trapping in trans-$(CH)_x$ ....See Entry 119911

Surface-enhanced Raman spectroscopy of water: implications of the electromagnetic model ....See Entry 120040

The role of cavity sites in surface-enhanced Raman scattering ....See Entry 120041

Infrared study of the adsorption of $^{16}O_2$, $^{16}O^{18}O$ and $^{18}O_2$ on Cr_2O_3 ....See Entry 120048

Infrared spectroscopic study of pyridine adsorption on $MoO_3.NiO$ catalysts supported on fluorinated γ-Al_2O_3 ....See Entry 120049

Infrared studies of the effect of preadsorbed pyridine on the oxidation of butan-2-ol adsorbed on TiO_2 ....See Entry 120050

Theoretical studies of the X-ray absorption near-edge structures (XANES) of hydrogen adsorbed metals ....See Entry 120179

Double losses and overtones in electron-energy-loss studies of surface vibrations: the role of lateral interactions ....See Entry 120202

Neutral-atom scattering from random isolated adsorbate atoms on clean metal surfaces: oxygen and carbon monoxide on nickel (001) ....See Entry 120211

Comparison of specular H-atomic-beam intensity and C^+ secondary-ion yield at thermally activated decrease of a carbon layer on a Ni (110) surface ....See Entry 120212

Core-level photoelectron spectroscopy of surfaces and adsorbates ....See Entry 120215

Initial stages of oxide formation on HgCdTe exposed to activated oxygen ....See Entry 120464

An electrochemical evidence of the O_2 photodesorption from n-TiO_2 surface ....See Entry 120675

Surface modification of polycrystalline p-$CuInS_2$ and p-$CuInSe_2$ electrodes for improved solar cell performance ....See Entry 120745

68.48 SOLID-SOLID INTERFACES

(inc. bicrystals; for grain boundaries, see 61.70N)

119353 (HgCd)Te-SiO_2 interface structure. J.A.Wilson, V.A.Cotton (Santa Barbara Res. Center, Goleta, CA, USA), J.Silberman, D.Laser, W.E.Spicer, P.Morgen.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1719-22 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
Low-temperature chemical vapor deposited (CVD) SiO_2 has proven to be a very important material for use as a passivation on HgCdTe, principally because it combines a high resistivity and low-temperature application with excellent interface electronic structure. As previously reported, capacitance measurements show no frequency dispersion, and N_{SS} minima below 1×10 cm^{-2} eV^{-1} have been realized. The authors report here on an investigation of the composition and structure of the interface between PHOTOX SiO_2 and HgCdTe. Wafers of zone melt HgCdTe, with $x=0.3$ and coated with PHOTOX SiO_2, were analyzed with simultaneous Auger electron spectroscopy (AES) and Ne ion milling. The surface of the wafer was also studied with AES and surface ellipsometry before the SiO_2 was deposited. Ellipsometry indicates the presence of a thin film on the HgCdTe due to the surface treatment, with thicknesses which vary between 10 and 20 Å from wafer to wafer. The AES measurements indicate a Te count rate similar to that in bulk HgCdTe, plus significant oxygen signal, indicating the thin film is predominantly Te-oxide. Sputter-Auger SiO_2 on HgCdTe shows an interface region width of ~50 Å. The dominant signals from this region are Si, O, and Te. The Te line shift indicates that an oxide is not present. The authors interpret this to indicate that the initial thin Te-oxide layer has been substantially reduced, leaving an interfacial layer of Si, Te, and O between the applied SiO_2 and HgCdTe. The increase in N_{SS} of interfaces formed on oxide-free HgCdTe indicate this interface layer is beneficial to device passivation. (9 refs.)

119354 Auger spectroscopy of metal-semiconductor interface in the In-$Pb_{1-x}Sn_xTe$ system. T.A.Grishina, I.A.Drabkin, Yu.P.Kostikov, A.V.Matveenko, N.G.Protasova, D.A.Sakseev.
Inorg. Mater. (USA), vol.18, no.10, p.1467-72 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1709-13 (Oct. 1982). [received: Sept. 1983]
The concentration profiles of chemical elements in In-$Pb_{1-x}Sn_xTe$ interface were studied by the method of Auger spectroscopy. It was shown that when In is thermally sputtered on $Pb_{1-x}Sn_xTe$, a chemical interaction between In and the semiconductor occurs. Deposition of $Pb_{1-x}Sn_xTe$ on In eliminates this interaction, but heating of the junction obtained causes chemical interactions between In and the semiconductor. A qualitative explanation is proposed for the chemical interaction processes occurring on the In-$P_{1-x}Sn_xTe$ interface. (13 refs.)

119355 Influence of substrate deformations on interface structures. II. Experimental investigations for epitaxial Ag/Pd and Au/Pd bicrystals. E.Pippel, J.Woltersdorf (Inst. fur Festkorperphys. und Elektronenmikroskopie, Akad. der Wissenschaften, Halle, Germany).
Phys. Status Solidi a (Germany), vol.79, no.1, p.189-98 (Sept. 1983).
For pt.I see ibid., vol.78, p.475 (1983). The influence of substrate relaxations on pseudomorphic growth in Ag/Pd island bicrystals and continuous Au/Pd films is investigated using transmission electron microscopy. For several substrate and deposit thicknesses the radii of curvature resulting from bending contours are measured. Further on the critical deposit thickness for complete pseudomorphism is deduced from the first appearance of misfit dislocations. Both quantities strongly depend on the bending of the substrate layer. The experimental results are compared with theoretical values. Finally, some contrast problems of misfit dislocations and moire lines are discussed as they arise in the case of epitaxial bicrystals. (15 refs.)

119356 Compound formation and bonding configuration at the Si-Cu interface. G.Rossi, I.Lindau (Stanford Electronics Labs., Stanford Univ., Stanford, CA, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3597-3600 (15 Sept. 1983).
Joint photoemission and Auger *LVV* line-shape spectroscopies on the Si-Cu interface show the existence of a silicidelike compound with bonding characteristics similar to those of the near-noble-metal silicides. This makes the Si-Cu interface different from the other noble-metal-Si interfaces where alloy-like phases (Si-Au) or narrow interfaces with concentration gradients (Si-Ag) are formed. The Si-Cu compound is metal-rich with a stoichiometry close to the eutectic composition Cu_3Si and is stable over a wide range of temperatures. (22 refs.)

119357 Silicon-gallium-phosphide heterostructures with a $(Si_2)_x(GaP)_{1-x}$ transition region. M.E.Boiko, L.B.Karlina, Yu.V.Shmartsev (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.559-60 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1299-302 (Nov. 1982). [received: Sept. 1983]
The authors report a study of silicon-gallium-phosphide semiconductor heterostructures with a $(Si_2)_{x}\cdot(GaP)_{1-x}$ transition region. The layers are grown under isothermal conditions on silicon substrates in the (111), (110) and (100) orientations from gallium or tin molten solutions which are initially undersaturated with respect to the components to be deposited and which trigger some dissolution of the substrate (nonequilibrium epitaxy). The growth time is 5-15 min, and the growth temperature range is 840-860°C. The thickness of the resulting films are 0.1-40 μm. The composition of the transition region is determined by X-ray spectral microanalysis. (7 refs.)

Kinetics of $TiSi_2$ formation by thin Ti films on Si ....See Entry 119280

The preparation and characterization of strained-layer superlattices in the GaAs+GaP system ....See Entry 119365

High-resolution imaging of inhomogeneities in superconducting tunnel junctions by scanning with a modulated electron beam ....See Entry 119776

Diffusional reaction-bonding of Si_3N_4 ceramics under high pressure ....See Entry 120285

Passivation properties and interfacial chemistry of photochemically deposited SiO_2 on $Hg_{0.70}Cd_{0.30}Te$ ....See Entry 120465

68.55 THIN FILM GROWTH, STRUCTURE, AND EPITAXY

(for techniques of crystal growth and film deposition, see 81.10 and 81.15)

119358 Preparation of Pb-Bi film by alloy evaporation. II. Microstructure and morphology. H.-C.W.Huang, C.M.Serrano (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1409-15 (1983).
For pt.I see Thin Solid Films, vol.91, p.201 (1982). In a previous paper, techniques were developed to obtain hexagonal-close-packed (27-32 wt.% Bi) Pb-Bi alloy films by evaporating from an alloy source. For the work reported here, Pb-Bi films were prepared under various evaporation rates, substrate temperatures, and residual gas pressures with a goal to obtain smooth and fine-grained films. Contrary to what is generally expected, the grain size, as measured at room temperature after sample warm up, increased by a factor of 3 to 5 when the substrate temperature T_s was lowered from 273 to ~180K and below. Evidence to be presented suggests that although fine grains were obtained at low T_s, significant grain growth has occurred when the films were warmed from $T_s < 200K$ to room temperature. Grain sizes of Pb-Bi films prepared at 77K were reduced when the films were doped with H_2O during deposition or seeded with 5-10 nm thick layers of Pb-Bi or O_2-doped Pb. But no grain size reduction was observed for films doped with O_2 at 77K or seeded with Au or Pd at 273K. The dependence of film morphology on composition, deposition rate, and substrate temperature were also investigated. For fine-grained Pb-Bi films prepared as described above, hillocks and/or holes were typically observed. (18 refs.)

119359 A technique using a Wheatstone bridge to study the minute differences in nucleation and growth of two metallic films. U.K.Chaturvedi, S.K.Agrawal, A.K.Nigam (Dept. of Phys., Banaras Hindu Univ., Varanasi, India).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1416-19 (1983).
A technique has been developed to study the differences in the nucleation and growth of metallic films during their vacuum thermal deposition. The '*P*' and '*Q*' resistance arms of a Wheatstone bridge are made equal and arms '*R*' and '*S*' are replaced by two substrates having proper contacts, facing the vapor source in the vacuum chamber. During deposition, if nucleation and growth conditions of the films on these substrates are exactly identical, no voltage difference is developed across the junctions '*PQ*' and '*RS*' of the bridge throughout the growth of the films. If, however, there is even a minute difference in the nucleation and growth sequence of these films, the critical time at which the films become conductive may be different for both the films which ultimately gives a rectangular pulse-type signal which is recorded by the X-Y recorder. As the critical thickness at which the metal film becomes suddenly conductive is dependent on a large number of factors, e.g. flux and species of vapor, structure and temperature of the substrate, residual gas pressure and its nature, fields present on or nearby the substrate, etc., this technique has potential applications in metallic thin film technology. (3 refs.)

119360 Growth kinetics of platinum silicide. M.Wittmer (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5081-6 (Sept. 1983).
The influence of substrate orientation and dopant on the growth kinetics of Pt_2Si and PtSi have been studied. It was found that the growth of both silicides is diffusion limited and independent of substrate orientation. However, on substrates doped with an arsenic concentration of 5×10^{20} cm^{-3} the preexponential factor of the PtSi growth kinetics is lowered by a factor of 2, but the activation energy remains unchanged. This change in the preexponential factor is independent of the Si substrate orientation. The results are discussed in terms of possible diffusion mechanisms in PtSi. (21 refs.)

119361 Metal-organic vapor deposition of CdTe and HgCdTe films. W.E.Hoke, R.Traczewski (Raytheon Res. Div., Lexington, MA, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5087-9 (Sept. 1983).
Epitaxial films of CdTe and HgCdTe have been grown on $\langle 111\rangle A$ CdTe substrates using metal-organic reagents. Specular CdTe films were grown at the investigated substrate temperatures between 370 and 410°C. Specular $Hg_{1-x}Cd_xTe$ films with $X\geq0.15$ were obtained at substrate temperatures of 400-410°C. The HgCdTe growth rate was nominally 6 μm/h for $Hg_{0.8}Cd_{0.2}Te$. The HgCdTe films are *n* type and a liquid nitrogen mobility of 140000 cm^2/V sec was measured for $Hg_{0.85}Cd_{0.15}Te$. The interdiffusion width at the CdTe-HgCdTe heterojunction is nominally 1 μm. (7 refs.)

119362 The role of lattice strain in the phase equilibria of III-V ternary and quaternary semiconductors. P.K.Bhattacharya, S.Srinivasa (Dept. of Electrical & Computer Engng., Oregon State Univ., Corvallis, OR, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5090-5 (Sept. 1983).
Liquidus and solidus isotherms for ternary $Ga_xIn_{1-x}As$ and $Al_xIn_{1-x}As$ and quaternary $In_{1-x}Ga_xAs_{1-y}P_y$ and $In_{1-x}Ga_xAs_{1-y}Sb_y$ alloy semiconductors have been calculated using the regular solution phase equilibria model for liquid phase epitaxial growth. The effect of lattice-mismatch strain in the growing layer has been incorporated in the model. Calculations have been made in order to make comparisons with published results of previous workers for both lattice-matched and mismatched layers. It is found that agreements are better with the inclusion of strain than with a zero-strain model. (30 refs.)

119363 Growth and photoluminescence spectra of high-purity liquid phase epitaxial $In_{0.53}Ga_{0.47}As$. P.K.Bhattacharya, M.V.Rao (Dept. of Electrical & Computer Engng., Oregon State Univ., Corvallis, OR, USA), Ming-Jong Tsai.
J. Appl. Phys. (USA), vol.54, no.9, p.5096-102 (Sept. 1983).
High-purity liquid phase epitaxial $In_{0.53}Ga_{0.47}As$ has been grown on semi-insulating (100) InP:Fe substrates. The electrical characteristics of the layers were determined from Hall measurements. Different melt-baking schemes were used to improve the purity of the grown layers. Such layers were *n*-type with N_D and $N_A\sim10^{14}$ cm^{-3} and with μ_{300K} and $\mu_{77k}=9000$ and 55000 cm^2/V s, respectively. High-resolution photoluminescence measurements were performed with the as-grown and heat-treated layers at temperatures down to 4.4K.. Measurements at different temperatures and with varying excitation intensity helped to elucidate excitonic and impurity-related transitions. The most intense peaks at the highest energies arise from bound excitons. Carbon is usually not detected in the LPE crystals except those grown after 100 h or longer melt baking. The binding energy E_A of carbon acceptors is 13.0 ± 1.0 meV. Other acceptor-related transitions observed in the spectra are Zn with $E_A=28.0\pm1.0$ meV and Si with $E_A=33.0\pm2.0$ meV. An LO-phonon replica of the Zn-related transition was consistently observed with $\hbar w_{LO}=32.0\pm1.0$ meV. From the measurements it transpires that the 0K band gap of $In_{0.53}Ga_{0.47}As$ is ~0.822 eV. (31 refs.)

119364 Residual shallow acceptors in GaAs layers grown by metal-organic vapor phase epitaxy. A.P.Roth, S.Charbonneau, R.G.Goodchild (Div. de Chimie, Conseil Nat. de Recherches, Ottawa, Ontario, Canada).
J. Appl. Phys. (USA), vol.54, no.9, p.5350-7 (Sept. 1983).
A study of the residual impurities present in GaAs layers grown by metal-organic vapor phase epitaxy has been conducted. Gallium arsenide layers were grown from three different trimethylgallium sources as a function of the substrate temperature and the arsine partial pressure which are the main factors controlling the concentration of residual impurities. A study of the low temperature photoluminescence spectra of the layers supported by preliminary secondary ion mass spectroscopy measurements shows that the major residual acceptors are carbon, magnesium, and zinc. (27 refs.)

119365 The preparation and characterization of strained-layer superlattices in the GaAs+GaP system. R.M.Biefeld, G.C.Osbourn, P.L.Gourley, I.J.Fritz (Sandia Nat. Labs., Albuquerque, NM, USA).
J. Electron. Mater. (USA), vol.12, no.5, p.903-15 (Sept. 1983).
The technique of metal organic chemical vapor deposition has been used to prepare strained-layer superlattices in the GaAs+GaP system. The superlattices consist of alternating layers of GaP and $GaAs_xP_{1-x}$ for x=0.2 to 1.0, which vary in thickness from 30 to 400 Å. The layers were grown by the decomposition of trimethylgallium and various mixtures of AsH_3 and PH_3 in H_2 at 800°C. The thickness and uniformity of the layers were determined by optical and transmission electron microscopy and X-ray diffraction. The composition of the layers was determined from X-ray diffraction. A new analysis has been developed to determine the layer strain as well as the composition of thick layers (~300 Å). Transmission electron microscopy has been used to yield direct evidence that strained-layer superlattices can be used to remove misfit dislocations generated during the epitaxial growth of a $GaAs_xP_{1-x}$ alloy on a lattice mismatched GaP substrate. These results are in agreement with the previous work of Matthews and Blakeslee (1977). Optical absorption, photocurrent spectroscopy and photoluminescence have been used to determine the band gap energy as well as the energies for other optical transitions. The values are in excellent agreement with the values predicted by tight binding and effective mass calculations. (11 refs.)

119366 Transient behaviour of intrinsic gettering in CZ silicon wafers. H.Tsuya, F.Shimura (Fundamental Res. Labs., Nippon Electric Co. Ltd., Kawasaki, Japan).
Phys. Status Solidi a (Germany), vol.79, no.1, p.199-206 (Sept. 1983).
The transient behaviour of intrinsic gettering (IG) is clarified for the first time on the silicon wafer with surface defects introduced by the pre-annealing in wet O_2 at 1140°C. It is found that surface defects introduced by the pre-annealing in O_2 at higher temperatures, which are speculated to be heavy metal clusters by the authors, migrate to an inner region and are gettered by inner defects during the post-annealing at lower temperatures such as 950°C. These results suggest that surface defects introduced by pre-oxidation process can be gettered during device heat treatment at comparatively lower temperatures if microdefect nuclei are suitably given. (19 refs.)

119367 Oxygen-bonding environments in glow-discharge—deposited amorphous silicon-hydrogen alloy films. G.Lucovsky, J.Yang, S.S.Chao, J.E.Tyler, W.Czubatyj (Energy Conversion Devices Inc., Troy, MI, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3225-33 (15 Sept. 1983).
Presents the results of a systematic study of oxygen incorporation in *a*-Si:H alloys produced by the glow-discharge decomposition of SiH_4, H_2, and O_2. The authors identify four oxygen-related absorption bands at 2090, 980, 780, 500 cm^{-1}, and show that the absorption strength in each band scales linearly with the oxygen concentration. They demonstrate that oxygen can increase the solubility of hydrogen in *a*-Si in the monohydride bonding geometry. The features identified above are shown to be characteristic of a bonding site in

which the oxygen and hydrogen atoms are bonded to the same silicon atom. They find no features in the infrared absorption that are associated with bonding configurations having OH groups. In films containing both oxygen and polysilane bonding, as evidenced by the doublet absorption at 845 and 890 cm^{-1}, they find no evidence for bonding sites in which a substantial fraction of the silicon atoms have one oxygen and two hydrogen neighbors. (14 refs.)

119368 Nitrogen-bonding environments in glow-discharge-deposited a-Si:H films. G.Lucovsky, J.Yang, S.S.Chao, J.E.Tyler, W.Czubatyj (Energy Conversion Devices Inc., Troy, MI, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3234-40 (15 Sept. 1983).
The authors have studied the local bonding of nitrogen atoms in a glow discharge-deposited films of a-Si:H by using IR absorption spectroscopy. They find two different bonding environments for N, which are identified through different frequencies for the Si-N asymmetric bond-stretching vibration, 840 cm^{-1} for the high-T_s films, and 790 cm^{-1} for the low-T_s films. In films deposited on substrates held at temperatures in excess of 300°C, the N is incorporated in a planar site with three silicon nearest neighbors, and one hydrogen second-nearest neighbor. In films produced on substrates held below 200°C, the N atom is also in a threefold-coordinated planar site, but with all of the nearest and second-nearest atoms being Si atoms. (18 refs.)

119369 Bonding in hydrogenated hard carbon studied by optical spectroscopy. B.Dischler, A.Bubenzer, P.Koidl (Fraunhofer-Inst. fur Angewandte Festkorperphys., Freiburg, Germany).
Solid State Commun. (USA), vol.48, no.2, p.105-8 (Oct. 1983).
Amorphous hydrogenated carbon thin films (a-C:H) were prepared by RF plasma deposition from benzene vapor. Optical absorption in the range 0.2-25.0 μm was measured and used for bonding analysis. Changes by thermal anneal in six steps between 250° and 600°C have been studied. The optical gap decreases from 1.2 to 0.17 eV upon annealing. The fine structure of the C-H stretch absorption spectrum (3400-2700 cm^{-1}) yields quantitative information on the fraction of sp^3, sp^2, and sp^1 hybridisation in the carbon network. In as-grown a-C:H $^2/_3$ of the carbon atoms are tetrahedrally coordinated (sp^3:sp^2:sp^1=68:30:2%). Thermal anneal above 300°C converts sp^3 into aromatic sp^2 with 63% sp^2 at 500°C and ~100% sp^2 at 600°C. (16 refs.)

119370 Local structure of amorphous $Mo_{50}Ni_{50}$ determined by anomalous X-ray scattering using synchrotron radiation. S.Aur, D.Kofalt, Y.Waseda, T.Egami (Dept. of Materials Sci. & Engng., Univ. of Pennsylvania, Philadelphia, PA, USA), R.Wang, H.S.Chen, Boon-Keng Teo.
Solid State Commun. (USA), vol.48, no.2, p.111-15 (Oct. 1983).
Anomalous (resonance) X-ray scattering technique using synchrotron radiation was applied to determine the compositionally resolved local structure of sputter deposited amorphous $Mo_{50}Ni_{50}$. The local environments of Mo atoms and Ni atoms were found to be significantly different from each other, but similar to the corresponding local environments in crystalline MoNi. The results compare favorably with those of the EXAFS measurement. (15 refs.)

119371 Two regions of amorphous state in CoPd alloy films of equiatomic composition. E.M.Artem'ev, A.S.Komalov, A.A.Smyk (L.V. Kirenski Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.547-8 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.949-50 (March 1983). [received: Oct. 1983]
The authors have investigated the crystal structure of Co-Pd alloy films of compositions close to equiatomic. These films were grown on various substrates, at various substrate temperatures T_s. They observed two regions of T_s in which films exhibiting a diffuse halo in electron diffraction patterns were obtained. The composition and thickness were monitored by X-ray fluorescence analysis. The films were condensed on substrates kept at temperatures T_s from −100 to 320°C. In the range of T_s from −100 to −10°C and from 150 to 190°C the investigated alloy was condensed in the amorphous state on all the substrates, including LiF and MgO single crystals, whereas in the range of T_s from 30 to 140°C a two-phase state was observed with an FCC phase (a=0.372 nm) and a BCC phase (a=0.322 nm), whereas at T_s above 200°C the films consisted of a single FCC phase with a=0.375 nm. (2 refs.)

119372 On the chlorine content in chemically sprayed tin oxide films: a quantitative analysis. I.Chambouleyron, C.Constantino, M.Fantini (Phys. Inst., Univ. Estadual de Campinas, Campinas, Sao Paulo, Brazil), M.Farias.
Sol. Energy Mater. (Netherlands), vol.9, no.2, p.127-38 (July-Sept. 1983).
SIMS and AES analyses have been performed on tin oxide films grown by the chemical spray method at temperatures ranging from 260 to 490°C. Compositional analysis shows that non-intentional chlorine doping is always present to an amount that strongly depends on reaction temperature. This effect was quantified and explained in terms of a competitive process between chlorine adsorption and chlorine volatilization during the incomplete hydrolysis reaction. The presence of hydrogen into the films as well as OH groups was detected albeit not quantified. (21 refs.)

119373 Investigation of copper oxide coatings for solar selective applications. A.Scherer, O.T.Inal, A.J.Singh (Dept. of Metall. & Materials Engng., New Mexico Inst. of Mining & Technol., Socorro, NM, USA).
Sol. Energy Mater. (Netherlands), vol.9, no.2, p.139-58 (July-Sept. 1983).
Copper was oxidized using thermal, chemical and electrochemical treatments in an attempt to obtain a solar selective surface with a reasonable thermal stability. Microstructural analyses using SEM and X-ray diffraction, were made to investigate the influence of heat treatment on the coatings. A non-linear programming technique was used to optimize the coating conditions using as-plated and heat-treated (10 h at 180°C) data. Since a marked difference between the as-plated and the heat-treated optima was observed, a systematic thermal stability study of the copper oxide at low temperatures (below 200°C) was conducted. The stability of the chemical oxidizing solution was also investigated. As-plated absorptances of 0.97 at emittances of 0.2 were obtained in the optimized coatings. After thermal treatment, these absorptances and emittances were substantially reduced (α=0.89, ϵ=0.10). This reduction at higher temperature is attributed to a chemical change in the coating composition. (11 refs.)

119374 Structural and optical studies of topotaxially-grown Cu_2S from sprayed CdS thin films. B.Rezig, J.Bougnot, M.el Hammouti, M.Perotin, V.Bay, M.Savelli (Centre d'Electronique de Montpellier, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Sol. Energy Mater. (Netherlands), vol.9, no.2, p.189-98 (July-Sept. 1983).
Thin Cu_xS layers are obtained by a wet conversion method (dipping) of CdS sprayed films of about 1 μm thickness. The structural evaluation of these copper sulfides involved phase identification as well as lattice and orientation parameters. X-ray diffraction, a nondestructive method, was systematically used to investigate partially or completely converted layers of undoped CdS. The results of the corresponding compositional and optical investigations are presented. (13 refs.)

119375 Characterizaiton of eptiaxial films of CdTe and CdS grown by hot-walled epitaxy. H.Sitter, J.Humenberger, W.Huber, A.Lopez-Otero (Inst. fur Experimentalphys., Univ. Linz, Linz, Austria).
Sol. Energy Mater. (Netherlands), vol.9, no.2, p.199-206 (July-Sept. 1983).
Using the method of hot-wall epitaxy, layers of n-type CdTe and CdS doped with indium were grown on monocrystalline BaF_2 and SrF_2 substrates, respectively. The authors measured mobilities of 600 cm^2/Vs for CdTe and 230 cm^2/Vs for CdS. The mobility of some samples increased exponentially with temperature in the temperature range of 300 to 100K. This effect can be explained by means of a grain boundary model. However, in other samples bulk scattering mechanisms play a significant role for temperatures lower than 100K. The mobility as a function of grain size was also investigated. For the characterization of carrier traps in the CdTe films the authors performed deep level transient spectroscopy measurements. They found six different defect levels in the upper half of the forbidden gap. (16 refs.)

119376 Preparation and properties of sputtered a-Si:H:F films. W.Beyer, J.Chevallier, K.Reichelt (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
Sol. Energy Mater. (Netherlands), vol.9, no.2, p.229-45 (July-Sept. 1983).
Amorphous Si:F, Si:H:F and Si:H films have been prepared by reactive sputtering of silicon. The film composition was investigated by Rutherford backscattering and by nuclear reaction techniques, the electronic properties by conductivity, thermopower and photoconductivity measurements and the thermal stability by gas evolution and annealing experiments. (38 refs.)

119377 Effect of conditions for producing amorphous metallic films of hypereutectic iron-boron alloy on their structure. G.M.Zelinskaya, A.V.Romanova, V.V.Nemoshkalenko, V.P.Naberezhnykh, B.F.Belov, V.V.Bukhalenko, A.G.Il'yinskii, A.I.Senkevich.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1393-9 (Sept. 1983). In Russian.
An X-ray examination was carried out for hypereutectic $Fe_{82}B_{18}$ melt in a temperature range of 1520−1820K and for vitreous films produced at various cooling rates and holding time of the melt before 'quenching' at almost liquidus temperature. An accelerated B diffusion to the surface is established and chemical composition of the sample surface in amorphous and crystalline states is determined. It is shown that the electron binding energy of Fe atoms is different for amorphous and crystalline states. The alloy structure in liquid and amorphous states is established to be microinhomogeneous as to the type of short-range order and distribution of the components. A rise in the melt temperature and an increase in holding time in the liquid state induce structural alterations. Low cooling rates may result in formation of a crystalline metastable Fe_3B phase with different crystalline cells. (9 refs.)

Synthesis and properties of $(CH)_x$-films prepared by polymerization of BTFM-TCDT .... See Entry 118911

Some aspects of Li behavior in ion implanted HgCdTe .... See Entry 119052

Radiation damage in epitaxial CaF_2 films on Si substrates by Ar^+ ion implantation .... See Entry 119071

Interaction of thin layers of Al and Ge with cleaved (Hg,Cd)Te surfaces .... See Entry 119279

Kinetics of ordering in two dimensions. I. Model systems .... See Entry 119341

Kinetics of ordering in two dimensions. II. Quenched systems .... See Entry 119342

Influence of substrate deformations on interface structures. II. Experimental investigations for epitaxial Ag/Pd and Au/Pd bicrystals .... See Entry 119355

Stress in chemical-vapor-deposited SiO_2 and plasma-SiN_x films on GaAs and Si .... See Entry 119378

Trends in optical parameters and band structure with increasing hydrogenation of amorphous silicon .... See Entry 119418

Amorphous silicon-phosphorus layer .... See Entry 119613

Epitaxial Si layer of Si-BP-Si structure .... See Entry 119692

The properties of Cr-Si-O thin film resistors by DC conventional sputtering .... See Entry 119716

Electrical, optical, and structural properties of semitransparent metallic layers .... See Entry 119718

Carrier depletion in sulfur doped epitaxial GaAs layer by boron ion implantation .... See Entry 119721

A study on the purity and SIMS profiling of MOVPE-cadmium mercury telluride .... See Entry 119723

Conductivity of heterocondensates of CdTe .... See Entry 119725

Temperature and thickness dependence of electrical conductivity of flash-evaporated InSb films .... See Entry 119731

Ion plated transparent conductive films .... See Entry 119732

Crystallographic structures and perpendicular magnetization of GdFe films sputtered with substrate bias voltage .... See Entry 119877

Comparative studies of mercury cadmium telluride single crystal and epitaxial .... See Entry 120023

Determination of the nitrogen doping of liquid phase epitaxy GaP and $Ga_xIn_{1-x}P$ alloys by optical absorption and photoluminescence .... See Entry 120114

Photoluminescence and lattice mismatch in InGaAs/InP .... See Entry 120124

Electroreflectance and crystal structure of thin zinc sulfide films .... See Entry 120170

Physical and electrochemichromic properties of RF sputtered tungsten oxide films .... See Entry 120172

Fabrication technologies of semiconductor materials .... See Entry 120228

Recent progress on LADA growth of HgCdTe and CdTe epitaxial layers .... See Entry 120244

The reactive sputtering of tantalum oxide: compositional uniformity, phases, and transport mechanisms .... See Entry 120245

Transparent conducting zinc oxide and indium-tin oxide films prepared by modified reactive planar magnetron sputtering .... See Entry 120246

Influence of the sputtering gas pressure on deposition profiles .... See Entry 120247

Radio-frequency sputtered indium tin oxide thin films .... See Entry 120248

Measurements of angular evaporation characteristics of sources .... See Entry 120249

Latest developments in the growth of $Cd_xHg_{1-x}Te$ and CdTe-HgTe superlattices by molecular beam epitaxy .... See Entry 120251

Growth of low dislocation density CdTe films on hydroplaned CdTe substrates by molecular beam epitaxy .... See Entry 120252

CVD growth of silicon using higher-order silanes .... See Entry 120253

Low pressure CVD process for micro and polycrystalline silicon .... See Entry 120254

Simple method for preparing hydrogenated amorphous silicon films by chemical vapor deposition at atmospheric pressure .... See Entry 120255

High-purity InP grown by hydride VPE technique with impurity gettering by indium source and oxygen .... See Entry 120258

Thin film studies of oxides by the organometallic-CVD technique .... See Entry 120259

A linear analysis of chemical vapour deposition processes for micro-electronics applications. I. Diffusive gas transport .... See Entry 120260

A linear analysis of chemical vapour deposition processes for micro-electronics applications. II. Surface effects .... See Entry 120261

Heavily boron doped crystalline silicon films by plasma technique .... See Entry 120263

Process for depositing thin, continuous metal films .... See Entry 120265

Horizontal slider LPE of (HgCd)Te .... See Entry 120266

Surface controlled crystallization of poly(tetramethylene terephthalate) .... See Entry 120267

Polymerization of acetylene with new catalysts, new doping agents, morphology and electrical conductivity of the doped polyacetylene films .. See Entry 120627

Chemical deposition of $Cd_{1-x}Hg_xS$ thin film electrodes for liquid-junction solar cells .... See Entry 120746

68.60 PHYSICAL PROPERTIES OF THIN FILMS, NONELECTRONIC

119378 Stress in chemical-vapor-deposited SiO_2 and plasma-SiN_x films on GaAs and Si. C.Blaauw (Bell-Northern Res., Ottawa, Ontario, Canada).
J. Appl. Phys. (USA), vol.54, no.9, p.5064-8 (Sept. 1983).
Stress was measured in films of chemical-vapor-deposited SiO_2 and plasma-deposited SiN_x on GaAs, in the temperature range 20-300°C, using the laser beam deflection method to measure the curvature of the substrate. Film thickness was in the range 1000-7500 Å. SiO_2 films with and without P doping were deposited at 425°C in a silox reactor. Stress in these films is independent of film thickness. The intrinsic stress σ_i is tensile with $\sigma_i=5.1\times10^9$ dyne/cm^2 and $d\sigma/dT=12.6\times10^6$ dyne/cm^2°C for undoped films. P doping decreases the value of each of these parameters. Films of SiN_x were deposited at 500°C in a plasma-reactor. Both σ_i and $d\sigma/dT$ decrease with film thickness, with values on the order of $5\text{-}15\times10^9$ dyne/cm^2 and $15\text{-}35\times10^6$ dyne/cm^2°C, respectively. Annealing of films, deposited on Si, at temperatures in the range 500-700°C does not affect stress in SiN_x. However, stress relief is observed in both undoped and P-doped films of SiO_2. (19 refs.)

Investigation of the melting point of thin films as a method of determining their elastic energy .... See Entry 119161

Electronic and ionic transport properties of electrodeposited polypyrrole films .... See Entry 119607

A study on the purity and SIMS profiling of MOVPE-cadmium mercury telluride .... See Entry 119723

Comparative studies of mercury cadmium telluride single crystal and epitaxial .... See Entry 120023

Recent progress on LADA growth of HgCdTe and CdTe epitaxial layers .... See Entry 120244

Growth of low dislocation density CdTe films on hydroplaned CdTe substrates by molecular beam epitaxy .... See Entry 120252

Horizontal slider LPE of (HgCd)Te .... See Entry 120266

Electron microprobe techniques for routine compositional analysis of (Hg,Cd)Te .... See Entry 120698

68.70 WHISKERS AND DENDRITES: GROWTH, STRUCTURE, AND NONELECTRONIC PROPERTIES

119379 Ion-bombardment-induced whisker formation on graphite. J.A.Floro, S.M.Rossnagel, R.S.Robinson (Dept. of Phys., Colorado State Univ., Fort Collins, CO, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1398-402 (1983).
The bombardment of surfaces with energetic ions has led to the development of various types of surface topography. In one special case, that of graphite, ion bombardment is responsible for the formation of whiskerlike structures. Whiskers formed under ion bombardment exhibit an initial rapid growth process followed by a slower, diffusion-fed process. The rates of lengthening and thickening during the diffusion-fed process appear to be constant in time. Whisker length increases nonlinearly with beam energy; population density decreases as beam energy increases. Whiskers grow parallel to the ion beam. Their alignment is apparently dominated by the destruction of nonparallel whiskers rather than electric field effects. Simultaneous impurity seeding inhibits whisker formation and can totally suppress formation if sufficient flux is present. A growth model involving stress relief at recrystallization front junctures qualitatively fits many experimental observations. (10 refs.)

68.90 OTHER TOPICS IN THE STRUCTURE AND NONELECTRONIC PROPERTIES OF SURFACES AND THIN FILMS

119380 On density profiles of ionic systems near a charged hard wall. M.F.Golovko, O.A.Pizio.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1379-83 (Sept. 1983). In Russian.
Ion density profiles near a charged hard wall are calculated. It is shown that the density profiles with widely ranging density, temperature and electric field intensity on the wall surface can be divided into three regions as to their form: Debye screening, specific ionic ordering, density ordering. Specific features of these regions are investigated in comparison with the ionic system without a wall. (17 refs.)

119381 Condensed states in a system of cluster ions. E.A.Manykin, M.I.Ozhovan, P.P.Poluektov.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1383-8 (Sept. 1983). In Russian.
Metastable condensed states in a system of cluster ions—ions surrounded by a macroscopic shell of a nonpolar fluid with a positive potential barrier at the vacuum-liquid interface—have been studied by means of the density functional theory. Equilibrium parameters are found for the condensed phase: density and binding energy. Lifetime, plasma frequency and surface tension have been estimated. (19 refs.)

Calculation of forces of molecular interaction of metals in vacuum over a broad region of distances .... See Entry 117952

70.00 CONDENSED MATTER: ELECTRONIC STRUCTURE, ELECTRICAL, MAGNETIC, AND OPTICAL PROPERTIES

(see also 81.40R Electrical and magnetic properties related to materials treatment, 81.40T Optical properties related to materials treatment)

71.00 ELECTRON STATES

(see also 63. Lattice dynamics, 73. Surfaces, interfaces, and thin films)

71.10 GENERAL THEORIES AND COMPUTATIONAL TECHNIQUES

119382 Calculations of the electronic ($4k_F$) and magnetic ($2k_F$) phase transitions from a Hubbard Hamiltonian with an exponentially dependent intersite-transfer integral. H.Th.Jonkman, H.J.Zwinderman, J.Kommandeur (Lab. for Phys. Chem., Univ. of Groningen, Groningen, Netherlands).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1281-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
An exponential intersite-dependence of the transfer integral in the Hubbard Hamiltonian together with $U\gtrsim3t$ in a quarter filled band lead to a separation of the $2k_F$ and $4k_F$ components of the Peierls transition. A phase diagram of the transition temperatures versus U/t can be constructed. The results for some physical properties such as the spin susceptibility can be favorably compared with experiment. (13 refs.)

119383 Electronic polarizabilities of a $^1/_4$-filled extended Hubbard model. D.J.Scalapino (Dept. of Phys. & Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA), J.E.Hirsch.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1507-11 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Varying the parameters in an extended Hubbard model leads to four electronic polarizabilities which can influence the lattice dynamics. Of particular interest is the $2p_F$ and $4p_F$ structure of these responses. Using a recently developed Monte Carlo method for the numerical simulation of such systems, the authors have studied the temperature and wave vector dependence of these polarizabilities. Here they present some results for the case of a quarter-filled ($\rho=0.5$) case. (9 refs.)

119384 Transfer integrals for TCNQ salts. G.Janssen, R.Visser, H.Th.Jonkman, J.De Boer, J.Kommandeur (Labs. for Phys. Chem., Univ. of Groningen, Groningen, Netherlands).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1587-91 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Transfer integrals are of prime importance in understanding the physical properties of TCNQ-salts, particularly since the crystal structures vary widely. This paper gives a reliable method of their calculation. (14 refs.)

119385 Improved numerical stability for norm-conserving ion-core pseudopotentials. P.C.Pattnaik (Texas Instruments Inc., Dallas, TX, USA), G.Fletcher, J.L.Fry.
Phys. Rev. B (USA), vol.28, no.6, p.3564-5 (15 Sept. 1983).
Analytic expressions are given for the inverse of the transformation matrix needed to utilize the recently published tables of norm-conserving ion-core pseudopotentials. These expressions eliminate a troublesome numerical instability and should greatly facilitate the use of the tabulated pseudopotentials. (3 refs.)

71.20 ELECTRONIC DENSITY OF STATES DETERMINATIONS

(inc. energy states of liquid semiconductors; see also 65.40 Lattice and electronic heat capacity)

Electronic states and conductivity in liquid and amorphous Fe .... See Entry 119407

Energy band structure and electronic transport properties of niobium monoxide .... See Entry 119429

Electronic structure and X-ray near-edge core spectra of Cu_2O .... See Entry 119433

Theoretical and experimental investigation of the optical properties of mixed-valence compound SmB_6 .... See Entry 119436

Possibility of a distortion induced gap in intermediate valence compounds .... See Entry 119520

Electrical properties of junctions between sputter deposited silicon films and monocrystalline silicon .... See Entry 119701

71.25 NONLOCALIZED SINGLE-PARTICLE ELECTRONIC STATES

119386 The energy V_0 of the quasi-free electron in gaseous, liquid and solid methane. U.Asaf, R.Reininger, I.T.Steinberger (Racah Inst. of Phys., Hebrew Univ., Jerusalem, Israel).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.363-6 (16 Sept. 1983).
Photoinjection experiments show that the energy V_0 of the quasi-free electron in methane is negative at all densities from the dilute gas to the solid with a minimum roughly coinciding with the mobility maximum. The results are in qualitative agreement with the Springett-Jortner-Cohen model (1968) and with Basak and Cohen's (1979) relationship between the mobility and V_0. (22 refs.)

119387 Two-dimensional electron momentum densities in Nb-Mo alloys. Y.Nakao, S.Wakoh (Dept. of Phys., Aoyama Gakuin Univ., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3122-6 (Sept. 1983).
The two-dimensional electron momentum densities in Nb-Mo alloys are calculated on the basis of the average t-matrix approximation scheme. The momentum densities obtained are transformed into the reduced **k**-space by means of the procedure proposed by Lock et al. The authors' results agree qualitatively with the experimental electron-positron pair momentum densities obtained from two-dimensional angular correlation of positron annihilation radiation.

119388 Electronic structure of the 2:1 charge transfer salts of TMTCF. P.M.Grant (IBM Res. Lab., San Jose, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.847-57 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors present a unified single-particle model capable of explaining a number of experimental facts pertaining to the high and low temperature/pressure regimes of $(TMTCF)_2X$. Special attention is paid to the nature and source of the interchain interaction in determining the overall physical properties of these materials. (27 refs.)

119389 Short-range Coulomb effects and the chemical systematics of conducting organic charge-transfer salts. A.N.Bloch, S.Mazumdar (Corporate Res. Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1273-9 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors show that the effects of short-range Coulomb interactions in molecular organic conductors depend very strongly on band filling because of intermolecular correlations. The entire class of materials thereby falls into a pattern consistent with experimental trends in magnetic susceptibility and $4k_F$ scattering. In the context of a general theory of fractional charge transfer and cohesive energy, a basis for limited chemical control of the short-range interactions is discussed. (17 refs.)

119390 Solitons in nearly commensurate organic charge transfer crystals. A.J.Epstein (Xerox Webster Res. Center, Webster, NY, USA), J.W.Kaufer, H.Rommelmann, J.S.Miller, R.Comes, J.P.Pouget.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1479-85 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
X-ray diffuse scattering, magnetic, and conductivity studies of $(N\text{-methylphenazinium})_x$ $(\text{phenazine})_{1-x}$ (tetracyanoquinodimethane) $[NMP_x (Phen)_{1-x} (TCNQ)]$ show the formation of defect states for $0.50 \lesssim x \lesssim 0.54$. These results are in agreement with the formation of solitons in a highly correlated quasi-one-dimensional system near the quarter-filled-band limit. (32 refs.)

119391 Solitons in quasi one-dimensional crystals. E.M.Conwell, I.A.Howard (Xerox Webster Res. Center, Webster, NY, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1487-92 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors show that the magnitude of the Peierls gap is decreased by the presence of solitons generated thermally or by doping, in highly correlated one-quarter filled band quasi one-dimensional crystals. (20 refs.)

119392 Phase-variable description of solitons in Peierls distorted state. H.Fukuyama (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan), J.Hara.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1501-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Simple description of the classification of possible solitons in the dimerized and the trimerized systems is presented in terms of phase variables defined by the bosonization of the interacting fermion fields. (27 refs.)

119393 Domain walls and their properties in quasi-one-dimensional crystals. L.P.Gor'kov, A.G.Lebed (L.D. Landau Inst. for Theoretical Phys., Acad. of Sci., Moscow, USSR).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1531-7 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The three-dimensional features in the electron energy spectrum of quasi one-dimensional (Q1D) conductors strongly favour formation of the soliton-like superstructure in a low temperature phase. The ground state properties reveal unusual behaviour. (15 refs.)

119394 Analytic calculation of the charge distribution around the soliton in the 1D system. I.Batistic (Inst. of Phys., Univ. of Zagreb, Zagreb, Yugoslavia), S.Barisic.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1543-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Solitons in the system with a fractionally filled band are studied within the framework of a continuum model. The variable phase method is employed in order to find the charge, the corresponding charge distribution and the localized state energy of a soliton of an arbitrary shape. (4 refs.)

119395 Electronic structure of soliton-like excitation in 1-D conductors. T.Murao (Dept. of Chem., Faculty of Sci., Kyoto Univ., Kyoto, Japan).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1583-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Soliton-like excitations which preserve the charge neutrality are investigated with the model based on the pseudopotential theory. (5 refs.)

119396 Local-density−functional approach to all-trans-polyacetylene. J.W.Mintmire, C.T.White (Naval Res. Lab., Washington, DC, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3283-90 (15 Sept. 1983).
A new first-principles self-consistent computational approach for determining the electronic properties of polymers is presented. The local-density−functional formalism in conjunction with a linear combination of atomic orbitals approximation is used to determine the geometry (by minimizing the total energy within a variational scheme) and electronic structure of periodic chain polymers. This method is applied to all-trans-polyacetylene, and leads to a theoretically calculated geometry, X-ray and ultraviolet photoelectron spectra, and dielectric function $\epsilon(q,w)$ in good agreement with experimentally determined values. (38 refs.)

The preparation and characterization of strained-layer superlattices in the GaAs+GaP system .... See Entry 119365

Electronic polarizabilities of a $^1/_4$-filled extended Hubbard model .... See Entry 119383

Theoretical studies of the physics of charged defect formation in doped organic polymers: towards a coherent theoretical picture .... See Entry 119513

Photoconductivity and the evolution of energy bands in fluid xenon .... See Entry 119661

Organic superconductors: three years only! .... See Entry 119739

Superconductivity and anomalous magnetotransport in $(TMTSF)_2ClO_4$ .... See Entry 119768

Crossover from localized to mobile electrons in Qn $(TCNQ)_2$ .... See Entry 119942

Applications of the modulated liquid crystal-linear dichroism (LC-LD) to spectro- and stereo-chemical problems. III .... See Entry 120019

Infrared and optical properties of $TMTSF_2X$ .... See Entry 120067

Electrochemical cells employing polyacetylene and poly(p-phenylene) as active materials .... See Entry 120732

71.25C Techniques of band-structure calculation (general theory, applications of group theory, analytic continuation, etc)

119397 Model calculations on the band structures of one-dimensional mixed donor-acceptor systems. M.C.Bohm (Inst. for Organische Chem., Univ. Heidelberg, Heidelberg, Germany), H.Vogler.
Phys. Rev. B (USA), vol.28, no.6, p.3342-61 (15 Sept. 1983).
The band structures of one-dimensional donor-acceptor (D-A) stacks have been studied by means of the crystal-orbital (CO) formalism based on the tight-binding approximation. The model polymers of the present study are composed of quinhydrone moieties (10 and 11) where the donor and acceptor groups show either a parallel or a perpendicular orientation. These idealized systems have been adopted as models for D-A polymers in the recently synthesized class of D-A phanes. The strength of the D-A interaction has been modified due to alterations of the D-A distances within the unit cells and due to modifications in the effective electronegativity of the active groups (hydroxyl and carbonyl). The computational framework is a semiempirical intermediate neglect of differential overlap (INDO) CO formalism with a variable model Hamiltonian that allowed the simulation of the different types of D-A interactions (weak versus strong D-A pairs). An insulator-metal transition is predicted in the 0° arrangement of 10 for short D-A distances and larger differences in the electronegativities of both fragments. The 90° conformation shows an avoided crossing between the highest filled and the lowest unfilled $\varepsilon(k)$ curves. This leads to a finite band gap for all studied interaction conditions. The band structures, the charge transfer in the D-A stacks, and the excited-state properties of 10 and 11 are analyzed as a function of the D-A geometry (distance, mutual orientation) and as a function of the strength of the D-A pairs. Semiquantitative solid-state models are compared with the INDO CO data, synthetic strategies for the design of D-A phanes with small (vanishing) band gaps are formulated, and various solid-state effects encountered in related low-dimensional D-A systems are briefly discussed. (60 refs.)

Effect of cluster size on the electronic properties of a chemisorption system .... See Entry 119348

Transfer integrals for TCNQ salts .... See Entry 119384

Many body theory of intermediate valence systems .... See Entry 119524

Convergence study of the density-gradient expansion for the screened-Coulomb exchange energy .... See Entry 119682

71.25H Measurement of Fermi surface parameters

(inc. dHvA, magnetoacoustic, position annihilation, and cyclotron resonance studies, etc.)

119398 Dingle temperatures and Fermi surface changes in Cu(H): an application of the impurity cluster formalism. J.Molenaar, A.Lodder (Natuurkundig Lab., Vrije Univ. Amsterdam, Amsterdam, Netherlands).
J. Phys. F (GB), vol.13, no.10, p.2063-75 (Oct. 1983).
The impurity cluster formalism has been extended to describe the scattering of Bloch electrons by a cluster centred around an interstitial impurity. An important feature of this extension is that the host wavefunction coefficients and Green function at the interstitial site can be obtained numerically from their values at the next-neighbouring atoms. The theory has been applied to Cu(H). Calculations of Dingle temperatures x^* and cross-sectional area changes δA reveal that x^* is mainly determined by the hydrogen potential, whereas δA is additionally sensitive to the environment of the hydrogen. The experimental x^* values can be nicely reproduced simulating screening effects by means of a potential shift. Charge neutrality is achieved satisfactorily using a seven-atom cluster which means that the influence of H is not restricted to its own muffin-tin sphere. Because of the sensitivity of δA to charge transfer the merits of the potentials available can be judged to their full extent only if this quantity is measured as well. The effect of lattice

distortion around H appears to be very small. Comparison of calculated and measured anisotropy of x^* confirms that the hydrogen occupies the octahedral and not the tetrahedral interstice in Cu. (13 refs.)

119399 Electronic structure of platinum. A.K.Bordoloi, S.Auluck (Phys. Dept., Univ. of Roorkee, Roorkee, India).
J. Phys. F (GB), vol.13, no.10, p.2101-5 (Oct. 1983).
An attempt is made to obtain a good fit to the Fermi surface of platinum using the interpolation scheme. The starting point is a set of parameters which give a good fit to the optical data. The authors find that it is possible to obtain a good fit to the Fermi surface as well as to the optical data. (11 refs.)

119400 Two-dimensional angular correlation of positron annihilation radiation in paramagnetic chromium. A.K.Singh, R.M.Singru (Dept. of Phys., Indian Inst. of Technol., Kanpur, India).
J. Phys. F (GB), vol.13, no.10, p.2189-96 (Oct. 1983).
Two-photon momentum densities and the two-dimensional angular correlation of positron annihilation radiation (2D ACPAR) in paramagnetic Cr are calculated by using the band-structure method due to Hubbard and Mijnarends (1972). The 2D ACPAR surfaces, $N(p_y, p_z)$, are calculated for four sets of momentum directions with p_x (the axis of integration) along the [110], [111], [100] and [112] directions. The results are presented and are discussed in terms of the contributions from different bands and the topology of the Fermi surface. The results indicate that in the first Brillouin zone the N-centred ellipsoidal hole pockets of paramagnetic Cr give rise to significant structure in the $N(p_y,p_z)$ surfaces. (32 refs.)

119401 The c-axis interaction in $(TMTSF)_2X$. P.M.Grant (IBM Res. Lab., San Jose, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1121-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The c-axis transfer integral is calculated in $(TMTSF)_2ReO_4$ and a value of approximately 1 meV is found. The author compares this result with critical field data and discusses its implications for quantum oscillation measurements and c-axis anion ordering. (8 refs.)

119402 Shubnikov-de Haas oscillations in TMTSF-DMTCNQ. S.Bouffard (Section d'Etude des Solides Irradies, CEN, Fontenay-aux-Roses, France), M.Ribault, D.Jerome, K.Bechgaard.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1437-40 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The observation of Shubnikov-de Haas oscillations in the metallic, high pressure phase of TMTSF-DMTCNQ demonstrates the three-dimensional, closed nature of the Fermi surface. Moreover, the authors discuss the high conductivity of TMTSF-DMTCNQ at low temperature. (8 refs.)

119403 Transport properties and Fermi surfaces in $HfTe_5$ and $ZrTe_5$. M.Izumi, K.Uchinokura (Inst. of Phys., Univ. of Tsukuba, Ibaraki, Japan), R.Yoshizaki, S.Harada, T.Nakayama, A.Yamada, E.Matsuura.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1705-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The Fermi surface of $ZrTe_5$ and $HfTe_5$ below 4.2K is determined by Shubnikov-de Haas oscillation measurement. That is a long cigarette shaped ellipsoid, reflecting quasi-two dimensional character of the crystal. The volume of the ellipsoid is very small, which may be strongly related to the existence of a phase transition or other anomalous properties of these pentatellurides. (9 refs.)

119404 Special points of the Brillouin zone and their use in the solid state theory. R.A.Evarestov, V.P.Smirnov (Dept. of Quantum Chem., Leningrad State Univ., Leningrad, USSR).
Phys. Status Solidi b (Germany), vol.119, no.1, p.9-40 (1 Sept. 1983).
Discusses the problem of the Brillouin zone integration in general; the different methods of using plane waves for this integration (so-called 'special point' schemes) are considered and compared with each other. In more detail the large unit cell method is discussed as the most simple and general one. Tables of mean value points and special point sets are given for some two- and three-dimensional crystalline structures. For the first time the dependence of the special point sets on the crystal point symmetry is taken into account, for noncubic lattices the connection of the special point sets with the lattice parameter relation is taken into account based on a simple graphic method. Applications of the special point theory in the calculation of crystalline solids are illustrated. (97 refs.)

119405 Fermi-surface nesting, closed orbits, and the 'threshold field' in an organic superconductor. J.F.Kwak (Sandia Nat. Labs., Albuquerque, NM, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3277-82 (15 Sept. 1983).
The Fermi surface of the organic superconductor $(TMTSF)_2PF_6$ (bis-tetramethyltetraselenafulvalenium hexafluorophosphate) should be open in a one-electron picture. Magnetotransport results, on the other hand, indicate the presence in the metallic state of small closed and compensated orbits. Such orbits can arise if there is an instability of commensurate wave vectors nesting the Fermi surface. The areas calculated here for these orbits are shown to strongly favor nonoptimal nesting over optimal nesting (i.e. the optimal areas are far too small). A model of instability commensuration change at the observed threshold associated with the Shubnikov-de Haas effect, driven by the magnetic field dependence of the Landau-level energies for the optimal orbits, is seen to be consistent with the present results and with many of the novel properties of this material. (35 refs.)

119406 Electron cyclotron absorption in *n*-InSb. A.K.Sharma (Dept. of Phys., Indian Inst. of Technol., New Delhi, India), O.P.Sharma.
Phys. Rev. B (USA), vol.28, no.6, p.3339-41 (15 Sept. 1983).
Following the technique of cyclotron absorption of electromagnetic radiation in relativistic plasmas the authors have studied the phenomenon of electron cyclotron absorption in *n*-InSb where nonparabolicity of the conduction band brings about effects similar to the relativistic effects. For transverse propagation ($\vec{k} \perp \vec{B}_s$) the absorption at low doping levels is considerably due to non-parabolic effects. At oblique angles the Doppler effect prevails over all other effects. For typical *n*-InSb parameters $n \sim 10^{14}$ cm^{-3}, $B_s \sim 5$ kG, $T \sim 77$K, the absorption length for transverse propagation turns out to be approximately equal to 0.2 cm. (6 refs.)

Renormalization of the *H*-point phonon anomaly in molybdenum .... See Entry 119123

Localization and interactions in a disordered electron gas .... See Entry 119517

Application of the Pippard-Klemens-Jackson theory of longitudinal magnetoresistance to a model of scattering on the Fermi surface of copper, silver, and gold .... See Entry 119550

Low temperature transport measurements on $(TMTSF)_2ClO_4$ .... See Entry 119565

Pressure effects in $HfTe_5$ and $ZrTe_5$ .... See Entry 119612

Generalized topological transition; the surface phase transition of order $2^1/_2$ .... See Entry 119686

Magnetoresistance of $(TMTSF)_2ClO_4$ .... See Entry 119758

71.25J Effective mass and g-factors

Shifted cyclotron resonance in $NbSe_3$ .... See Entry 119918

Plasma reflection and hole optical effective mass in p-HgTe .... See Entry 120082

71.25L Electron energy states in liquid metals

119407 Electronic states and conductivity in liquid and amorphous Fe. S.K.Bose, L.E.Ballentine, J.E.Hammerberg (Dept. of Phys., Simon Fraser Univ., Burnaby, Canada).
J. Phys. F (GB), vol.13, no.10, p.2089-99 (Oct. 1983).
The linear combination of atomic orbitals method is applied to clusters of 365 atoms, which are constructed to model the pair distribution functions of liquid and amorphous Fe. From these models the authors compute densities of states, spectral functions and electrical conductivities. Densities of states are quite similar in both models. Some evidence of residual *E-k* dispersion relations is found in the peaks of the spectral functions, but no evidence is found for any negatively sloped portion of the *E-k* curve. Although s states are found to be more mobile than d states, the conductivity is dominated by d states because of their much greater density. (37 refs.)

On the applicability of the nearly free electron model to resistivity calculations for liquid metals .... See Entry 119541

71.25M Electron energy states in amorphous and glassy solids

119408 Spectral studies on the electronic structure of polyacetylene. J.Tanaka, M.Tanaka, H.Fujimoto, M.Shimizu (Dept. of Chem., Nagoya Univ., Nagoya, Japan), N.Sato, H.Inokuchi.
J. Phys. Colloq. (France), vol.44, no.C-3, p.279-84 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The change of the optical spectra of polyacetylene upon doping is studied by measurements of visible, infrared and photoelectron spectra. The infrared spectra of the doped film showed new peaks with lowering the temperature. (11 refs.)

119409 Elementary excitations of a linearly conjugated diatomic polymer. M.J.Rice (Xerox Webster Res. Center, Webster, NY, USA), E.J.Mele.
J. Phys. Colloq. (France), vol.44, no.C-3, p.393-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Studies the low-lying excitations of a linearly conjugated diatomic polymer. (5 refs.)

119410 Self-consistent crystal potential and band structure of three-dimensional trans-polyacetylene. P.M.Grant, I.P.Batra (IBM Res. Lab., San Jose, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.437-42 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Calculates the three-dimensional band structure of ideally crystalline trans-polyacetylene using a self-consistent pseudopotential technique and have obtained the charge density distribution within the unit cell. The authors find trans-$(CH)_x$ to be highly anisotropic in its one-electron properties and therefore suggest that the interchain soliton/kink interactions might be quite weak. (15 refs.)

119411 Tight-binding studies for electroactive organic polymers. M.L.Elert (Chem. Dept., US Naval Acad., Annapolis, MD, USA), J.W.Mintmire, C.T.White.
J. Phys. Colloq. (France), vol.44, no.C-3, p.451-4 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
A tight-binding model is presented which accurately reproduces the valence band structure of both graphite and diamond. The model is used to calculate the band structure and density of states of polyacetylene, and agreement with experimental XPS results is seen to be excellent. It is suggested that the model should be useful in predicting the valence band electronic structure of a wide range of carbon-based polymers. (15 refs.)

119412 Electronic structure of some conducting polymers. B.R.Bulka (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland).
J. Phys. Colloq. (France), vol.44, no.C-3, p.459-62 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Using the continued fraction method for a tight binding Hamiltonian, the electronic structure of pure and doped infinite polymer chains as polyheptadiyne, polyphenylene and polythienylene is studied. It is shown that these polymers are semiconductors. There are intramolecular defects, which can hop along a chain. (2 refs.)

119413 Study of disorder in polyacetylene. M.Kabbaj, M.Jestin, J.P.Albert, C.Jouanin (Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.463-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Investigates the effects of disorder on the electronic states of polyacetylene. In effect, due to the impurities and variable environment, one would expect some fluctuations in both the self-energies (diagonal disorder) and the hopping integrals (off-diagonal disorder). The consequences of each type of disorder and their relative importance are discussed. (6 refs.)

119414 Electronic correlations and midgap absorption in polyacetylene. Z.G.Soos, L.R.Ducasse (Dept. of Chem., Princeton Univ., Princeton, NJ, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.467-70 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Electronic correlations are important when they lift degeneracies of one-electron models. Spin-independent electron-electron interactions are examined through exact Pariser-Parr-Pople (PPP) analysis of midgap absorption ($E_g/2$) of finite odd polyenes, whose doublet ground state is associated with neutral solitons of Su, Schrieffer, Heeger (SSH). The electronic correlations lift the two-fold degeneracy of the $E_g/2$ absorption and all the dipole intensity goes to the upper state close to E_g while the nondegenerate transition at $E_g/2$ of charged solitons are by contrast insensitive to electronic correlations. Thus, charged solitons dominate the absorption around $E_g/2$. The observed variations of absorption spectra in $(CH)_x$ upon light doping are qualitatively explained by this model. (8 refs.)

119415 Effects of off-diagonal disorder on soliton- and polaron-like states in trans-polyacetylene. C.T.White, M.L.Elert, J.W.Mintmire (Naval Res. Lab., Washington, DC, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.481-4 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Reports on some exact results the authors have obtained that show off-diagonal disorder can have a significant effect on the Peierls band edges of polyacetylene as well as polaron-like gap states in this system. The results also prove that such disorder leaves many of the more important properties of soliton-like defects largely unaffected. (7 refs.)

119416 Thermal transformation of local to extended electronic states in polyacrylonitrile. J.Fink (Kernforschungszentrum Karlsruhe, Inst. fur Angewandte Kernphys. I, Karlsruhe, Germany), J.J.Ritsko, G.Crecelius.
J. Phys. Colloq. (France), vol.44, no.C-3, p.683-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The electronic structure of pyrolyzed polyacrylonitrile treated at pyrolysis temperatures of 200-600°C has been studied by electron energy loss spectroscopy. (12 refs.)

119417 π electron delocalization in poly-(p-phenylene) (PPP), polyphenylene sulfide (PPS) and polyphenylene oxide (PPO) and AsF_5 doping of PPP. J.Fink, G.Crecelius, J.J.Ritsko, M.Stamm, H.J.Freund, H.Gonska (Inst. fur Angewandte Kernphys. I, Kernforschungszentrum Karlsruhe, Karlsruhe, Germany).
J. Phys. Colloq. (France), vol.44, no.C-3, p.741-4 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The relative widths of π bands in poly-(p-phenylene), polyphenylene sulfide and polyphenylene oxide are deduced from electron energy loss experiments. From measurements of the chemical shift of the carbon K absorption edge, the charge on carbon atoms in different coordination is estimated. In AsF_5 doped poly-(p-phenylene) two states inside the gap have been seen, consistent with a bipolar model for the conductivity. (14 refs.)

119418 Trends in optical parameters and band structure with increasing hydrogenation of amorphous silicon. N.Savvides, D.R.McKenzie, R.C.McPhedran (School of Phys., Univ. of Sydney, Sydney, NSW, Australia).
Solid State Commun. (USA), vol.48, no.2, p.189-93 (Oct. 1983).
The authors have studied the optical properties of hydrogenated amorphous silicon films prepared by sputtering a silicon target in an argon/hydrogen plasma and varying hydrogen partial pressure between zero and 0.5 Pa. They report values of the optical constants n and k in the photon energy range 0.5-6.5 eV. The imaginary part of the dielectric constant ϵ_2 and the effective number of valence electrons per silicon atom n_{eff} are deduced. They are used to obtain qualitative information on the band structure as a function of hydrogen partial pressure. Low to intermediate pressure films show properties consistent with hydrogen compensating dangling bonds and a general reduction in disorder in the films. High pressure films show abnormal changes in the ϵ_2 spectra and n_{eff} which are interpreted as evidence of H-induced defects in the gap and broadening of the valence band tail. Overall the observations are consistent with a recently proposed two-phase model for Si-H alloys. (24 refs.)

119419 Band structure of nonclassical polymers. N.Tyutyulkov (Inst. of Organic Chem., Acad. of Sci., Sofia, Bulgaria), P.Schuster, O.Polansky.
Theor. Chim. Acta (Germany), vol.63, no.4, p.291-304 (1983).
It is shown that fully conjugated alternant nonclassical polymers are comparatively stable systems as a result of the considerable delocalisation energy. The energy characteristics of the polymers are strongly determined by the electron spin distribution of the degenerate nonbonding molecular orbitals; the full spin configuration, $S>0$, is favoured. The spin densities depend on the electron correlation and alternate; this corresponds to a ferrimagnetic state of the polymer at 0K. (23 refs.)

Electronic states and conductivity in liquid and amorphous Fe .... See Entry 119407

Electrical and structural properties of a new conducting polymer: pyrolytic poly (p-phenylene-1,3,4-oxadiazole) .... See Entry 119537

Photogenerated gap states in polyacetylene .... See Entry 119998

The chemical structure of conducting polyheterocyclic films: XPS studies .... See Entry 120703

71.25P Band structure of crystalline metals

119420 Electronic structure and bonding in transuranics: comparison with lanthanides. J.W.Ward (Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.279-92 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
The physicochemical properties of actinide metals beyond uranium and their alloys and compounds show interesting parallels and contrasts with the rare earths. At first there is a transition region where the unique bonding properties of the early actinides become less prominent owing to progressive f electron localization. Nevertheless, in contrast with the rare earths, the f electron energies remain close to the Fermi level, resulting in complex behavior as a function of temperature, pressure and structure. Particularly interesting in this region are the metallic hydrides, whose chemistry is clearly rare earthlike but whose electronic properties are entirely different. At americium a major localization and f band narrowing occurs, but the explanation of americium behavior is obscured by the occurrence of this unique f^6 non-magnetic solid state configuration. Beyond americium, it would appear that real rare-earthlike behavior finally begins; this has been borne out by recent studies on the thermodynamics and cohesive energies of curium, berkelium, californium and einsteinium metals. However, a new complication arises almost immediately in the onset of incipient stabilization of the divalent state, which first appears in californium, whose physicochemical properites are remarkably similar to those of samarium. Einsteinium appears to be fully divalent, thus heralding the beginning of a mini series of truly divalent metals. (34 refs.)

119421 Split-off narrow d-band states above E_F in transition-metal alloys. F.U.Hillebrecht, J.C.Fuggle, G.A.Sawatzky, R.Zeller (Inst. fur Festkorpersforschung, KFA Julich GmbH, Julich, Germany).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1187-90 (26 Sept. 1983).
The presence is shown of narrow early-transition-metal d bands in the unoccupied states, sometimes several electronvolts above the occupied states, in alloys of early with late transition metals. The widths of these states are small if the early-transition-metal concentration and the host density of states above E_F are both low. Their relationship to the narrow resonances of impurities in metals and their possible relevance to optical properties are discussed. (22 refs.)

119422 Generalized theory of neutron scattering from hydrogen in metals. R.C.Casella (Nat. Measurement Lab., NBS, Washington, DC, USA).
Phys. Rev. B (USA), vol.28, no.6, p.2927-36 (15 Sept. 1983).
A recent analysis by the author of inelastic scattering of neutrons from dilute hydrogen in metals in terms of coherent itinerant-proton energy bands is generalized to include incoherent processes such as the spontaneous decay of the proton from excited-oscillator states to the ground state, as well as incoherent hopping among excited local-oscillator states centered at neighboring interstitial occupancy sites. Similarly, the analysis of Chudley and Elliott of quasielastic neutron scattering and its extension by Row, Skold, Flowtow, and Rush are generalized to include coherent hopping (band transport) in the self-correlation function describing motion of the proton among neighboring oscillator ground states (and, when applicable, among excited states). The general formalism developed here encompasses quasielastic and inelastic scattering and allows for the coexistence of coherent and incoherent processes. At each level of complexity, the expressions obtained for the cross sections are shown to reduce to earlier results in the limits when either the coherent or the incoherent contributions to the neutron bandwidths can be ignored. (18 refs.)

119423 Electron structure of transition-metal alloys with arbitrary far order. V.E.Egorushkin, A.I.Kul'ment'ev (V.D. Kuznetsov Siberian Physicotech. Inst., Tomsk State Univ., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.12, p.1093-111 (Dec. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.12, p.29-49 (Dec. 1982). [received: Oct. 1983]
The generalization of multiple scattering formalism permits calculation of the electron energy spectrum and state density in binary alloys of transition elements with arbitrary far order. Calculations performed for the ordered alloy FeCo show that the method can be used successfully for study of real systems of this type. The features of electron subsystem evolution with change in order completely determine the character of the order-disorder phase transition. (52 refs.)

119424 Electronic structure of transition metals under pressure. N.I.Kulikov (Inst. of High-Pressure Phys., Acad. of Sci., Ukrainian SSR).
Sov. Phys. J. (USA), vol.25, no.12, p.1112-22 (Dec. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.12, p.50-62 (Dec. 1982). [received: Oct. 1983]
The author demonstrates the advances made in the intensive study of the behavior of the electronic structure of metals under pressure in recent years. The alloys of transition metals, including intermetallic ordered compounds, have for the time being proved to lie outside the scope of this review, mainly because of the lack, in practice, of theoretical calculations in this area. Clearly, progress in this field is also being held up by the lack of detailed experimental investigations devoted to the behavior of alloys under pressure. This is due to the complexities involved in carrying out many traditional experimental procedures under high pressures. (56 refs.)

119425 Electron configuration and X-ray emission spectra of intermetallic compounds with CsCl structure. V.V.Nemoshkalenko, V.N.Antonov (Inst. of Metal Phys., Acad. of Sci., Ukrainian SSR).
Sov. Phys. J. (USA), vol.25, no.12, p.1135-48 (Dec. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.12, p.79-94 (Dec. 1982). [received: Oct. 1983]
The different compounds with CsCl structure possess a whole series of unique properties: elevated hardness, a magnetic properties, high melting point, properties associated with the shape memory effect, etc. This attracts the persistent attention of researchers to an experimental and theoretical study of the electron configuration of these compounds since the electron subsystem precisely determines their physical properties to a significant degree. Moreover, compounds with the CsCl structure have a comparatively simple crystalline structure, which facilitates the construction of theoretical models to describe their physical properties. The authors select for the analysis just certain of the most interesting, theoretical investigations and pay special attention to those in which a comparison is made with X-ray emission spectra. Such a selection is explained by the fact that the X-ray emission spectrum is one of the most effective direct methods of studying the electron configuration of solids. X-ray emission spectra carry information about the energetic distribution of the electrons of different symmetry over the whole width of the valence band and can be a criterion for the correctness of the theoretical computations. (67 refs.)

Magnetic, chemical and structural ordering in transition metals .... See Entry 119821

Investigation of the electronic band structure of gold by means of spin-polarized photoelectrons .... See Entry 120221

71.25R Band structure of crystalline elemental semiconductors

Hall-coefficient factor and inverse valence-band parameters of holes in natural diamond .... See Entry 119638

71.25T Band structure of crystalline semiconductor compounds and insulators

119426 Relation between the electronic states and structural properties of $Hg_{1-x}Cd_xTe$. A.-B.Chen (Phys. Dept., Auburn Univ., Auburn, AL, USA), A.Sher, W.E.Spicer.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1674-7 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
Physical reasons are presented for the coherent potential approximation (CPA) calculation method's ability to predict little band-gap bowing or alloy scattering, while at the same time predicting large deviation from virtual crystal behavior in other energy ranges. Accurate treatment of structural properties requires that calculations be doubly self-consistent: a density functional method plus CPA is needed. Experimental values of bond energies are greater than those predicted by simple theories. Weakened HgTe bonds in alloys help to explain the loss of Hg when the materials undergo surface treatments. (15 refs.)

119427 Empirical tight binding description of $Hg_{1-x}Mn_xTe$ and $Hg_{1-x}Cd_xTe$. K.C.Hass, H.Ehrenreich (Dept. of Phys., Harvard Univ., Cambridge, MA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1678-82 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
Presents the first theoretical treatment of the electronic structure of $Hg_{1-x}Mn_xTe$. As in the authors' previous work on $Hg_{1-x}Cd_xTe$, a semiempirical tight binding approach is employed, based in part on atomic energy levels. Harrison's universal tight binding scheme, and existing experimental band structure information. The occupied Mn spin-polarized *d* bands are discussed and shown to have little effect on the states near the band edges. The *s-p* electron 'complex band structure' of $Hg_{1-x}Mn_xTe$ is calculated in the CPA. Previous results for $Hg_{1-x}Cd_xTe$ are extended and used as a basis of comparison. The more rapid increase of the band gap with x in $Hg_{1-x}Mn_xTe$ is shown to result from the larger energy difference between cation *s* levels. This difference also gives rise to more pronounced disorder effects in $Hg_{1-x}Mn_xTe$. These are discussed in the context of the CPA results for damping, band gap bowing, and the limiting electron mobilities. (31 refs.)

119428 Band gap variation and lattice, surface, and interface 'instabilities' in $Hg_{1-x}Cd_xTe$ and related compounds. W.E.Spicer, J.A.Silberman, I.Lindau (Dept. of Electrical Engng., Stanford Univ., Stanford, CA, USA), A.-B.Chen, A.Sher, J.A.Wilson.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1735-43 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
The authors bring into focus the differences between $Hg_{1-x}Cd_xTe$ (MCT) and 'ordinary' semiconductors such as column 4, 3-5, and most 2-6 compounds. The key characteristic of MCT which makes it both different and of practical interest is the variation of band gap with composition (0 to 1.5 eV). The same unusual characteristic of the Hg atomic states which leads to the advantageous movement of band gap with composition weakens the bonding of Hg in the lattice. This bonding weakness exhibits itself in many ways in the characteristics of MCT, both at surfaces and interfaces and in the bulk. Because of this there is a potential instability associated with the surface or interface; however, this instability depends critically on the crystalline perfection of the MCT to depths far below the surface. The reason for this is defects move from the bulk to the surface (or in the opposite direction) with surprising ease—even at room temperature. The extreme susceptibility of MCT to mechanical damage is also related to the weakness of the Hg bonding. A first attempt is made at showing how the Hg bonding affects the electronic structure, lattice bonding, and defect structure of MCT. A key phenomenon in the electronic structure is the breakdown of the virtual crystal potential approximation. This breakdown is selective and involves only those valence states near zone boundaries containing large cation *s* wave function admixtures. This again reflects the unusual character of the Hg atomic 6 s^2 valence state. (30 refs.)

119429 Energy band structure and electronic transport properties of niobium monoxide. W.E.Wahnsiedler (Alcoa Tech. Center, PA, USA).
J. Solid State Chem. (USA), vol.49, no.2, p.195-205 (Sept. 1983).
The energy band structure of niobium monoxide was calculated by augmented plane wave techniques including detailed calculations of the potential between APW spheres in the lattice. Predictions of isotropic electronic transport parameters were made from the band structure. The results yielded a density of states which was compatible with the X-ray photoelectron spectrum of the material. The band structure was consistent with a material with highly metallic properties. The work function was calculated as 9.4 eV, larger than observed. This difference may be due to an assumed one-electron charge transfer between the Nb and O APW spheres. Hall coefficients calculated from the band structure fell within observed ranges, but transverse magnetoresistances were larger than observed. A variety of possible phenomenon were advanced to account for this discrepancy. (31 refs.)

119430 Band structure of $TlGaSe_2$. S.G.Abdullaeva, N.T.Mamedov, G.S.Orudzhev (Inst. of Phys., Acad. of Sci., Baku, Azerbaidzhan SSR).
Phys. Status Solidi b (Germany), vol.119, no.1, p.41-8 (1 Sept. 1983).
A mode of the $TlGaSe_2$-I band structure of the monoclinic modification is proposed. The monoclinic modification of $TlGaSe_2$-I is considered as a deformed tetragonal one. The band structure of the metastable tetragonal modification of $TlGaSe_2$-II is calculated by the pseudopotential method. The irreducible representations of the $D_{4h}{}^{18}$ group ($TlGaSe_2$-II) are expanded in irreducible representations of the $C_s{}^4$ group ($TlGaSe_2$-I). It is found that the top of the valence band is located at the point Y $(0,2\pi/b_m,0)$ of the $TlGaSe_2$-I Brillouin zone and is formed from band states N_2, N_4 of the tetragonal modification. The bottom of the conduction band is located at the point Γ of the $TlGaSe_2$-I Brillouin zone and is formed from T_4 states. An additional extremum of the valence and conduction bands is located at the points $\Gamma(A_2)$ and $Y(N_6,N_8)$, respectively. An interpretation of the absorption spectra of $TlGaSe_2$-I near the fundamental edge is proposed. (13 refs.)

119431 Experimental band structure of cadmium sulfide. N.G.Stoffel (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3306-19 (15 Sept. 1983).
The author has investigated the bulk electronic structure of wurtzite CdS using angle-resolved photoelectron spectroscopy with synchrotron radiation. He finds that direct transitions largely determine the shape of the experimental spectra. Information from all high-symmetry points in the Brillouin zone is available from normal- and off-normal-emission spectra with the aid of polarization selection rule. A comparison with experimentally determined critical-point energies shows that existing theoretical band-structure calculations for wurtzite CdS are qualitatively correct, but underestimate the extent of the band dispersion. For example, he observes an upper-valence-band width of 4.5 eV, which is significantly larger than the predicted values of 2.7-3.3 eV. The spectra also reveal fine structure in the Cd4*d* core-level spectra. This suggests that the Cd4*d* electrons are involved in the chemical bonding. (55 refs.)

119432 Site inequivalence in $Fe_{1+x}Nb_{3-x}Se_{10}$. G.K.Wertheim, F.J.DiSalvo, D.N.E.Buchanan (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3335-8 (15 Sept. 1983).
$Fe_{1+x}Nb_{3-x}Se_{10}$ has a novel structure made up of trigonal prismatic and octahedral coordinated metal atoms. The Se atoms are of two major types, those bound in Se pairs and single Se atoms, and while only Nb cations are found on the trigonal sites and the Fe (along with the remaining Nb) is found on the octahedral sites. To permit the study of the effects of disorder and site inequivalence on the electron structure of this compound, the X-ray photoelectron spectra of the core and valence electrons were examined. The spectra show two distinct types of Se. The relative intensities of the two Se spectra and comparisons with the spectra of related compounds identify the Se at greater binding energy with the closely spaced Se pairs in the trigonal chains and those at smaller binding energy with the rest of the Se atoms. The spectra of the Nb atoms in the two different sites were not resolved and differ by not more than 0.2 eV in binding energy. However, the Nb3*d* spectra showed more broadening than in similar compounds, probably due to the Nb site inequivalence and disorder intrinsic to the octahedral chains. All Nb atoms are consequently chemically similar. Chemical shifts indicate an oxidation state for Nb in $Fe_{1+x}Nb_{3-x}Se_{10}$ between those of $NbSe_2$ and $NbSe_3$. The spectra of the Fe atoms were relatively broad, and showed no resolved structure. These results are consistent with a recent semiempirical tight-binding band calculation which suggests that the conduction-electron density is low and resides mainly on the trigonal prismatic chain.

119433 Electronic structure and X-ray near-edge core spectra of Cu_2O. J.Robertson (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3378-85 (15 Sept. 1983).
A new tight-binding band structure of Cu_2O is presented from a fit to the valence-band density of states and low-energy band gaps. The depths of core excitons and the near-edge structure of the O K edge are calculated using the $Z+1$ approximation to the core-hole potential and the local density of states of the excited atom. The chemical trends of its impurity level are predicted and partial densities of states are found. (24 refs.)

119434 Electronic structure and optical properties of solid methane. A.B.Kunz (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3465-73 (15 Sept. 1983).
The electronic structure of solid methane, including the virtual levels is studied in a self-consistent Hartree-Fock model as a function of the lattice constant. It is found that the band gap is a sensitive function of pressure. It is also found that the resulting accuracy of the conduction bands depends heavily upon the quality of the virtual orbitals, a fact not appreciated in previous studies on solid CH_4. It is found essentially to include correlations explicitly in order to facilitate a comparison to experiment. This is done by means of perturbation theory. The inclusion of Coulomb correlations causing the formation of excitons in the excited spectra is accomplished by means of degenerate perturbation theory in the continuum. Results are compared to experiment. (23 refs.)

119435 Band structure, spontaneous polarization and index of refraction above and below the Curie point of $BaTiO_3$ and $KNbO_3$. L.Castet-Mejean (Lab. de Phys. Electronique, Univ. Lyon I, Villeurbanne, France).
Solid State Commun. (USA), vol.48, no.4, p.385-7 (Oct. 1983).
The spontaneous polarization influence on the refractive index of $BaTiO_3$ and $KNbO_3$ perovskites is analysed from their band structure. The coupling effects between the conduction band edge and the spontaneous polarization are expressed through the Bloch orbital interactions and allow one to interpret the presence of a precursor polarization in the paraelectric phase and the refractive index experimental data. (10 refs.)

119436 Theoretical and experimental investigation of the optical properties of mixed-valence compound SmB_6. O.V.Farberovich, S.I.Kurganskii, K.K.Sidorin, M.G.Karin, V.N.Bobrikov, G.P.Nizhnikova, A.I.Shelykh, M.M.Korsukova, V.N.Gurin (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.404-7 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.708-14 (March 1983). [received: Oct. 1983]
A modified variant of the orthogonalized plane wave method is used to calculate the energy band structure of SmB_6, which is a mixed-valence compound. A histogram of the interband density of states $I(\omega)$ is plotted and the first order of perturbation theory is used to calculate the multiplet structure of the perturbed configuration f^4d. Measurements are reported of the optical reflection spectrum of samarium hexaboride in a wide energy range from 0.05 to 40 eV. The Kramers-Kronig relationships are used to find the spectrum of the imaginary part of the permittivity ϵ_2 and its interpretation is based on the theoretical function $I(\omega)/\omega^2$ and on the multiplet structure of the excited configuration f^4d. (20 refs.)

The bonding properties of mercury-cadmium telluride ....See Entry 118948

Growth and photoluminescence spectra of high-purity liquid phase epitaxial $In_{0.53}Ga_{0.47}As$ ....See Entry 119363

Structural properties of III-V zinc-blende semiconductors under pressure ....See Entry 119494

Possibility of a distortion induced gap in intermediate valence compounds ....See Entry 119520

Transverse magnetoresistance and Hall effect in wide-gap, p-type $Hg_{1-x}Mn_xTe$ ....See Entry 119632

Analysis of mixed conduction effects in semi-insulating gallium arsenide ....See Entry 119668

HgCdTe heterojunctions ....See Entry 119693

On the determination of the energy band offsets in $Hg_{1-x}Cd_xTe$ heterojunctions ....See Entry 119694

Semiconducting behavior of Ag_2Te thin films and the dependence of band gap on thickness ....See Entry 119726

Magnetoresistance of $(TMTSF)_2ClO_4$ ....See Entry 119758

^{93}Nb NMR study of $NbSe_3$ ....See Entry 119928

Reflection spectra of $LiTaO_3$ in the fundamental absorption region ....See Entry 120111

Low temperature photoluminescence of *n*-type GaInAsP layers grown on InP by liquid phase epitaxy ....See Entry 120127

Energy spectrum of electrons of solid solutions in the TiC-TiN system ....See Entry 120199

Vacancy effects in the X-ray photoelectron spectra of TiN_x .See Entry 120223

Micro-scaled spectral-resolved cathodoluminescence of grains in barium titanate ceramics ....See Entry 120457

71.30 METAL-INSULATOR TRANSITIONS

119437 Structural energy and stability condition of the Peierls state. T.Murao (Dept. of Chem., Kyoto Univ., Kyoto, Japan), Y.Nagaoka.

J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.2976-8 (Sept. 1983).

The structural energy associated with the Peierls instability in 1-D conductors can be expressed as $\delta U = cA^2 + dA^2$, A being the order parameter. Because of the dependence of c on the Peierls-gap, the minimized δU still has the quadratic term of A in addition to the usual quartic term. The occurrence of Peierls transition still depends on the balance between the band-structure term and the electrostatic term in the pseudopotential theory.

119438 Theory of anion ordering in TMTSF compounds. R.Bruinsma (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), V.J.Emery.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1115-20 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

A strong coupling theory is developed for anion ordering in $(TMTSF)_2X$, where X is a tetrahedral anion. The effect of pressure is considered and an explanation is found for the thermal cycling effects in $(TMTSF)_2ClO_4$ and $(TMTSF)_2ReO_4$. (12 refs.)

119439 Suppression of the Peierls transition by chemical modification. G.Saito, T.Enoki, H.Inokuchi (Inst. for Molecular Sci., Okazaki, Japan), H.Kobayashi.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1215-18 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

In an organic cation radical salt, [bis(ethylenedithiolo)tetrathiafulvalene]$_2$ClO$_4$[1,1,2-trichloro-ethane]$_{0.5}$, a remarkable suppression of metal to semiconductor transition is achieved and a quasi metallic character is observed down to 1.4K. The electrical, optical, and structural data show this salt is almost two-dimensional (2D). The authors propose practical molecular designing of organic metals with strong interchain interaction, which possibly become organic superconductors of the $(TMTSF)_2X$ type. (17 refs.)

119440 Diffuse X-ray studies of the Peierls and the spin Peierls transitions in TMTTF-TCNQ and TMTTF-bromanil. S.Kagoshima (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France), H.Anzai.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1289-94 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

Structural phase transitions found in quasi one-dimensional conductors TMTTF-TCNQ and TMTTF-bromanil are characterized as the Peierls and the spin-Peierls transitions, respectively. Differences of properties between these two compounds are discussed. (23 refs.)

119441 Phase transitions in TMAITCNQ by resonance Raman spectroscopy. A.D.Bandrauk, K.D.Truong, C.Carlone, S.Jandl (Groupe de Recherches sur les Semiconducteurs et Dielectriques, Faculte des Sci., Univ. de Sherbrooke, Sherbrooke, Quebec, Canada).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1473-7 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

Measurements of Raman linewidths, frequencies and intensities of the ν_1 symmetric mode of $I^{-}{}_3$ are presented as a function of temperature and are correlated with various degrees of participation of the iodine chains in the phase transitions of TMA I TCNQ. (14 refs.)

119442 On the possibility of two phase transitions in HMTTF-TCNQ. J.Solyom (Central Res. Inst. for Phys., Budapest, Hungary).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1569-72 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

It is shown by using symmetry considerations in the framework of the Landau theory that HMTTF-TCNQ can undergo two subsequent phase transitions even though there is a single charge density wave in the system with temperature independent wave vector. (7 refs.)

119443 Metal-insulator transition in incommensurate Peierls chains by extinction of the Frohlich conductivity. P.Y.Le Daeron, S.Aubry (Lab. Leon Brillouin, CENS, Gif-sur-Yvette, France).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1573-7 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

A new metal-insulator transition with respect to the electron-phonon coupling is investigated in one-dimensional incommensurate conductors. This transition is essentially due to the competition between the Fermi and the lattice periods. (7 refs.)

119444 Scaling behavior near the pinning transition of the discrete Frenkel-Kontorova model. S.N.Coppersmith (Bell Labs., Murray Hill, NJ, USA).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1579-82 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

The discrete Frenkel-Kontorova model, used to study a one-dimensional solid in a periodic potential is examined in the incommensurate region. The behavior of the system near the transition from an unpinned to a pinned phase (first discussed by Aubry) is investigated. A disorder parameter and a correlation length are defined and shown numerically to obey scaling relations on both sides of the transition. (7 refs.)

119445 Erasable optical switching in semiconductor organic charge-transfer complexes. R.S.Potember, R.C.Hoffman, R.C.Benson, T.O.Poehler (Appl. Phys. Lab., Johns Hopkins Univ., Laurel, MD, USA).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1597-604 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

Semiconducting organo-metallic films such as silver and copper tetracyanoquinodimethane (TCNQ) have been observed to switch between two stable states when exposed to optical radiation. Observations of switching between two states in these films have been made by Raman spectroscopic methods and electrical resistance changes. Line or pattern generation is observed for exposure above certain threshold levels. Results of the spectral response and power density dependence on the optical switching threshold are also presented. These results are interpreted in light of activation energy and optical absorption spectra measurements and the proposed mechanism of electric field effect switching in these organic materials. (16 refs.)

119446 Charge density wave dynamics in the incommensurate and commensurate TaS_3. P.Monceau, H.Salva, Z.Z.Wang (Centre de Recherches sur les Tres Basses Temperatures, CNRS, Grenoble, France).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1639-45 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

TaS_3 crystallises in two structures with an orthorhombic and monoclinic unit cell. These two compounds undergo Peierls transitions: the orthorhombic one at $T_0=212K$ and the monoclinic one, which is isotypic with $NbSe_3$, shows two independent transitions at $T_1=240K$ and $T_2=160K$, incommensurate with the lattice and with a temperature independent periodicity slightly above and below four lattice constants along the chain axis. The authors have measured electrical resistivity, the depinning electric field, the fundamental frequency in the noise between the voltage leads for both compounds as a function of the temperature. These measurements and electronic microscope diffraction patterns clearly indicate an incommensurate-commensurate transition at $T_0'=140K$ for the orthorhombic TaS_3. The current carried by the CDW varies linearly with the fundamental noise frequency. The different models for the extra-conductivity will be reviewed. (19 refs.)

119447 Electric field induced structural changes in $NbSe_3$?. R.M.Fleming, C.H.Chen, D.E.Moncton (Bell Labs., Murray Hill, NJ, USA).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1651-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

The authors present a study of the charge-density wave (CDW) coherence and a search for possible electric field induced structural changes of the CDW in $NbSe_3$. Results from both synchrotron X-ray scattering and dark-field electron microscope images are presented. They find from synchrotron scattering that the CDW exhibits long range order. They find no apparent field-induced changes of the CDW either in the synchrotron results or the dark-field images. (14 refs.)

119448 New results obtained by electron diffraction on the one-dimensional conductors TaS_3 and NbS_3. C.Roucau (Lab. d'Optique Electronique, CNRS, Toulouse, France).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1725-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

By using electron diffraction on orthorhombic TaS_3, the author has investigated the variation with temperature of the distortion wave vector associated with a charge density wave. This compound undergoes an incommensurate-commensurate transition which is observable by transport measurements at 130K. The results he obtained on the variety II of NbS_3 led him to propose new lattice parameters for this material. Moreover, he determined the components of the wave vectors of the two lattice distortions which are present at room temperature. (8 refs.)

119449 X-ray observation of 1-D precursor effects in $NbSe_3$ and new diffuse scattering features in $FeNb_3Se_{10}$. J.P.Pouget, R.Moret, A.Meerschaut, L.Guemas, J.Rouxel (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1729-31 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

Two sets of diffuse sheets perpendicular to the chain direction have been observed at different wave vectors in $NbSe_3$. They clearly reveal the presence of quasi-one-dimensional fluctuations above the phase transitions of this compound. New diffuse scattering features have been also observed in $FeNb_3Se_{10}$. (11 refs.)

119450 Switching and hysteresis in $NbSe_3$. G.Gruner, A.Zettl (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1745-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

The authors have studied the hysteretic 'switch' associated with the development of the current-carrying charge density wave (CDW) state in $NbSe_3$, and find evidence for an intermediate 'fibrillating' state. The switch itself may be associated with a finite time required to couple various CDW regions, thus forming a coherent current-carrying state. (17 refs.)

119451 Characterization of the CDW transition in orthorhombic TaS_3 by thermoelectric power and magnetic susceptibility measurements. D.C.Johnston, J.P.Stokes, Pei-Ling Hsieh, G.Gruner (Corporate Res. Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1749-52 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

The magnetic susceptibility (4-340K) and thermoelectric power (50-300K) of orthorhombic TaS_3 are reported. The Peierls transition at $T_p=215K$ manifests itself as a peak in the temperature derivative of both quantities. These measurements indicate that strong one dimensional fluctuations occur well above T_p, that the compound is a wide-band ($\simeq 5$ eV) metal at $\gtrsim 300K$, and that Coulomb correlations are not important in determining the electronic properties of this material. (8 refs.)

119452 Effect of disorder on the charge density wave transitions and transport in orthorhombic TaS_3. Pei-Ling Hsieh, F.de Czito, A.Janossy, G.Gruner (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1753-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Temperature and electric field dependent conductivity studies are reported on alloys of orthorhombic TaS_3 with Nb and Se. The Peierls transition is depressed and also broadened by impurities. The threshold electric field for the onset of nonlinear conduction E_T is proportional to the square of the impurity concentration. (11 refs.)

119453 Peierls transition in the quasi-one dimensional blue bronzes $K_{0.30}MoO_3$ and $RbO_{0.30}MoO_3$. C.Schlenker, C.Filippini, J.Marcus, J.Dumas (Groupe des Transitions de Phases, CNRS, Grenoble, France), J.P.Pouget, S.Kagoshima.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1757-60 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Transport and X-ray diffuse scattering studies on the blue bronzes $K_{0.30}MoO_3$ and $Rb_{0.30}MoO_3$ show that the semiconductor to metal transition at 180K is of Peierls type. Nonlinear conductivity observed in the incommensurate semiconducting phase is attributed to the sliding of the charge density waves. (10 refs.)

119454 Two CDW's locking model in orthorhombic TaS_3. M.Renard, Z.Z.Wang (Centre de Recherches sur les Basses Temperatures, Grenoble, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1761-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Contrarily to $NbSe_3$ or monoclinic TaS_3, the orthorhombic variety of TaS_3 has a single CDW transition. The CDW wave vector is a function of T and becomes commensurable at $T_0=130K$. The authors propose a model based on the locking of two waves with a single wave vector and a single order parameter, to give an account of both crystallographical and nonlinear transport phenomenas. (8 refs.)

119455 Metal-insulator transition and scaling for incommensurate systems. M.Kohmoto (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1198-201 (26 Sept. 1983).
Tight-binding models in one dimension with incommensurate potentials are studied. For the sinusoidal-potential model scaling of the spectrum is found numerically at the critical point, which separates the region where all the states are extended and the region where all the states are localized. Absence of scaling for generic potentials indicates the existence of mobility edges. An index δ, which characterizes the behavior of the total width of allowed energies, is defined at the critical point. For a class of discontinuous potentials, the systems are found to be always critical. (20 refs.)

119456 Optical study of electron localization approaching a polarization catastrophe in liquid K_x-KCl_{1-x}. W.Freyland, K.Garbade, E.Pfeiffer (Phys. Chem., Philipps-Univ. Marburg, Marburg, Germany).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1304-6 (3 Oct. 1983).
The absorption constant $K(\nu)$ and refractive index $n(\nu)$ have been measured at photon energies of $0.5 \leq h\nu \leq 5.5$ eV in liquid K_x-KCl_{1-x} solutions for $0.001 \leq x \leq 0.05$ and temperatures up to 900°C, approaching the metal-nonmetal transition. The absorption spectra give clear evidence for F-center states existing at all x in equilibrium with aggregated centers, probably small metal clusters. The dielectric susceptibility increases with x by almost 2 orders of magnitude. A fit of the dielectric enhancement by a critical form yields a critical exponent, $\zeta=1.4\pm0.2$. (14 refs.)

119457 Peierls and spin-Peierls phase transitions in systems with coupled softening modes. Y.Lepine (Dept. de Phys., Univ. de Montreal, Montreal, Quebec, Canada).
Phys. Rev. B (USA), vol.28, no.5, p.2659-67 (1 Sept. 1983).
Peierls and spin-Peierls-type phase transitions are studied in quasi-one-dimensional systems where the distortion of the lattice is described by more than one normal mode. A model is chosen to describe this situation in the case of two coupled normal modes. A possibility of intrinsic structural instability is also included. A mean-field treatment is effected for a three-dimensional lattice and the following results have been obtained as a function of Γ, the strength of the coupling between the two normal modes: (1) the distortions corresponding to each normal mode occur at the same temperature, i.e. the transition temperature is unique; (2) the transition temperature increases when Γ decreases; finally, (3) for negative coupling energies ($\Gamma<0$) there exists a value of Γ_c, of Γ, such that for $\Gamma<\Gamma_c$ the transition is of first order and for $\Gamma>\Gamma_c$ the transition is of second order. This model is applied to the alkali-metal tetracyanoquinodimenthanide salts. It is found that, qualitatively, the dependence of the transition temperature on cation size and the order of the phase transition can be adquately understood in terms of the present model. (25 refs.)

119458 Self-consistent scaling theory of the metal-insulator transition in disordered systems. Y.Gefen (Dept. of Phys. & Astron., Tel Aviv Univ., Tel Aviv, Israel), Y.Imry.
Phys. Rev. B (USA), vol.28, no.6, p.3569-72 (15 Sept. 1983).
The authors propose a self-consistent description of the diffusion of electrons dressed by the Coulomb exchange interactions in a disordered system, as the metal-insulator transition is approached from the metallic side. The critical anomalies of the single-particle density of states and dielectric function are evaluated each in terms of the other. New scaling laws between the critical behaviors of these quantities as well as the diffusion constant and the frequency-dependent conductivity are obtained. It is argued that the density of states which appears in the expressions for the conductivity and the dielectric function becomes the anomalous one for frequencies higher than some relaxation rate of the many-body system. (25 refs.)

Anion ordering in $(TMTTF)_2ReO_4$: a displacive transition ..... See Entry 118945

Chemistry and characterization of group V transition metal trichalcogenides ..... See Entry 118982

New one-dimensional Vb transition metal tetrachalcogenides structural and transport properties ..... See Entry 118984

Calculations of the electronic ($4k_F$) and magnetic ($2k_F$) phase transitions from a Hubbard Hamiltonian with an exponentially dependent intersite-transfer integral ..... See Entry 119382

Model calculations on the band structures of one-dimensional mixed donor-acceptor systems ..... See Entry 119397

Structural properties of III-V zinc-blende semiconductors under pressure ..... See Entry 119494

The Bechgaard salts: magnetotransport, dimensionality, spin density waves and the threshold field ..... See Entry 119563

AC conductivity of near-commensurate charge density waves—application to $NbSe_3$ and TaS_3 ..... See Entry 119588

TCNQ simple salts of diquaternised 4,4′-bipyridyl ..... See Entry 119672

The Bechgaard phase, asymmetric anions and $T_c>3K$ ..... See Entry 119738

A sulphur based organic molecular superconductor: $(BEDT\text{-}TTF)_4(ReO_4)_2$ ..... See Entry 119740

Superconductivity and metal-nonmetal transitions in $(TMTSF)_2ClO_4$ ..... See Entry 119741

High-pressure optical absorption and X-ray-diffraction studies in RbI and KI approaching the metallization transition ..... See Entry 120021

Peierls instability of the organic linear chain semiconductor TEA $(TCNQ)_2$ [Raman study] ..... See Entry 120070

Infrared studies of phase transitions in single- and two-chain organic charge transfer conductors ..... See Entry 120071

Spectral studies of the phase transitions in MTPP$(TCNQ)_2$ and MEM$(TCNQ)_2$ ..... See Entry 120072

Far-infrared properties of trimethylammonium idodide tetracyanoquinodimethane ..... See Entry 120074

Optical properties of laser-melt-quenched Au-Si alloys ..... See Entry 120173

Positron annihilation as a probe of electronic density in the two-dimensional conductor 1T-TaS_2 ..... See Entry 120176

71.35 EXCITONS AND RELATED PHENOMENA

(inc. electron-hole drops)

119459 Triplet excitons in MEM$(TCNQ)_2$. S.Oostra, P.de Lange, R.J.J.Visser (Lab. of Phys. Chem., Univ. of Groningen, Groningen, Netherlands).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1383-5 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
In the ESR spectrum of MEM$(TCNQ)_2$ at low temperature, three pairs of triplet lines have been observed. Their dipolar splitting is fairly small. These lines either occur because the $2k_F$ distortion in MEM$(TCNQ)_2$I is so small or because coupled spins are observed on neighbouring chains. (4 refs.)

119460 Biexcitons in crystals with large ortho—para-exciton splitting. A.I.Bobrysheva, S.A.Moskalenko (Inst. of Appl. Phys., Acad. of Sci., Kishinev, Moldavian SSR).
Phys. Status Solidi b (Germany), vol.119, no.1, p.141-6 (1 Sept. 1983).
It is shown that in a system of ortho- and para-excitons two ortho-excitons with total spin $S=0$ interact attractively and biexcitons can be formed. The interaction potential of two ortho-excitons is approximated by a generalized Morse potential depending on the electron-hole mass ratio σ. On this basis the energy of vibrational and rotational levels of the biexciton is obtained. The binding energy of the biexciton ground state is estimated for all values of σ. (9 refs.)

119461 New approach to the exciton-phonon problem. A.Oswald (Inst. fur Festkorperforschung, Kernforschungsanlage Julich, Julich, Germany), I.Egri.
Phys. Rev. B (USA), vol.28, no.6, p.3291-9 (15 Sept. 1983).
With the use of the equation-of-motion method for electron-hole pairs, the influence of a phonon field on both gap energy and exciton energy is studied for finite temperatures. Free- and bound-polaron corrections as well as nonlocal, dynamic, phonon-mediated electron-hole interaction are obtained. These are evaluated analytically assuming parabolic bands, dispersionless optical phonons, and a hydrogenic 1s wave function for the exciton. Numerical variation with respect to the Bohr radius yields the exciton energy. For zero temperature, the resulting binding energy agrees well with other theories and experimental values for a number of direct-band gap cubic materials. (22 refs.)

119462 Self-trapped exciton and rare-gas impurity centers in solid Ne. C.H.Leung (Div. of Sci., Univ. of New Brunswick, Saint John, New Brunswick, Canada), L.Emery, K.S.Song.
Phys. Rev. B (USA), vol.28, no.6, p.3474-81 (15 Sept. 1983).
The structure of the atomic-type self-trapped exciton in solid Ne is studied using a hybrid method in which the inner shells of an atom are represented by the ion-size parameters of Bartram, Stoneham, and Gash (1968), while the two outermost s,p shells are treated exactly as in the extended-ion model. The electronic wave function and the lattice relaxation are determined self-consistently by minimization of the total energy of the system. The lattice is found to dilate around the excited Ne atom by an amount corresponding to about five vacancies. The calculated absorption energy of the self-trapped exciton for $\Gamma_1 \rightarrow \Gamma_{15}$ (atomic $3s \rightarrow 3p$) transition is in good agreement with the experimental data of Suemoto and Kanzaki (1980, 1981). The impurity centers of rare-gas atoms in a Ne host are also studied by the same method. The results show the existence of a small cavity around the impurity atoms, and account satisfactorily for the changes in the optical transition energies from gas to solid. (27 refs.)

119463 Strain confinement and thermodynamics of free excitons in a direct-gap semiconductor. D.P.Trauernicht, A.Mysyrowicz, J.P.Wolfe (Phys. Dept., Univ. of Illinois, Urbana, IL, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3590-2 (15 Sept. 1983).
Long-lived paraexcitons have been confined by a strain-induced parabolic potential well in Cu_2O. The excitons are found to behave as a highly diffusive classical gas at the crystal lattice temperature, as determined from their spatial and energy distributions between 1.5 and 4.2K. Strain confinement and spatially selective resonant excitation provide a new method for examining the thermodynamics and interparticle kinetics of this direct-gap exciton. (7 refs.)

119464 Two-dimensional electron-hole system in a strong magnetic field. Yu.A.Bychkov, E.I.Rashba (L.D. Landau Inst. for Theoretical Phys., Moscow, USSR).
Solid State Commun. (USA), vol.48, no.4, p.399-402 (Oct. 1983).
A theory of a 2-D e-h system in a strong magnetic field is presented. Its properties drastically depend on the existence of the e-h symmetry in it. In an asymmetric system excitons interact with each other and as a result can form magnetic biexcitons. The system is unstable to the formation of a charge-density waves (CDW) at low temperatures. (8 refs.)

119465 Investigation of the structure of many-particle exciton-impurity complexes bound to phosphorus atoms in silicon. A.S.Kaminskii, V.A.Karasyuk, Ya.E.Pokrovskii (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. Phys.-JETP (USA), vol.56, no.6, p.1295-1303 (Dec. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.6, p.2237-51 (Dec. 1982). [received: Oct. 1983]
The fine structure of no-phonon luminescence lines α_m (m is the number of bound excitons) due to many-particle exciton-impurity complexes bound to phosphorus atoms in silicon was investigated experimentally and theoretically. The fine structure was calculated for an excited state of a bound exciton ignoring the interaction with an inner-shell electron Γ_1, even in the presence of uniaxial strains and magnetic fields. One-particle wave functions were used in this calculation and an allowance was made for the symmetry of the electron and hole states dependent on the direction and sign of strain. In these approximations the fine structure was found to be governed by six interaction constants. On compression along the [001] axis the spectrum of the α_2 line consisted of three components, but four components were observed when tension was applied. A comparison of the calculations and experiments yielded the interaction constants, which were then used to calculate other spectra. The calculated spectra of the α_2 line in magnetic fields were in good agreement with the Zeeman α_2 spectra recorded on compression along the [001] axis. An investigation was made of the spectra of the α_2 line in the case when strains were applied along the [111] and [110] axes. A numerical calculation was made of these spectra and a qualitative agreement with the experiments was obtained. In the absence of strain, about ten components were resolved in the α_2 spectrum. Energy level schemes were proposed for the initial and final states and these accounted for the structure of the α_2 line. Details of the fine structure of the α_3 and α_4 lines could not be resolved, probably due to the large number and broadening of the components. (20 refs.)

119466 'Acceptor' and 'donor' excitons bound to transition-metal impurities in II-VI semiconductors. K.A.Kikoin, V.I.Sokolov, V.N.Flerov, V.V.Chernyaev (Inst. of Chem. Phys., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.6, p.1351-61 (Dec. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.6, p.2335-47 (Dec. 1982). [received: Oct. 1983]
The electroabsorption method is used to investigate narrow lines on the edge and in the interior of the photoabsorption band of nickel-doped ZnSe. These lines are interpreted as the first experimental proof of the amorphous character of exciton capture by a transition-metal impurity: the lines on the photoabsorption edge correspond to capture of an electron by a d-shell and of a hole by a hydrogenlike orbit ('acceptor' exciton), while capture of a line in the interior of the photoabsorption band corresponds to formation of a 'donor' exciton with a hole in the d-shell. A theory for amphoteric bound excitons is developed and the effect of giant enhancement of the oscillator strength following optical excitation of a donor exciton is explained. (25 refs.)

The temperature dependence of coherent two-photon processes in naphthalene in the strong exciton-photon coupling regime ....See Entry 118206

Growth and photoluminescence spectra of high-purity liquid phase epitaxial $In_{0.53}Ga_{0.47}As$ ....See Entry 119363

Electronic structure and optical properties of solid methane ..See Entry 119434

The polariton soliton formation due to the effect of the dipole momentum saturation ....See Entry 119469

Polariton excitations in gyrotropic crystals ....See Entry 119471

The scattering of charge carriers in large electron-hole drops in germanium ....See Entry 119595

Photoconductivity and the evolution of energy bands in fluid xenon ....See Entry 119661

Excitonic superconductivity—the missing link ....See Entry 119753

Excited triplet state EPR of sigma-bonded TCNQ dimers in $[Cu(DMP)_2]_2[TCNQ]_2$ ....See Entry 119901

Spin-orbit splitting of Γ exciton bands in RbI and KI .... See Entry 120032

Identification of residual donors in high-purity epitaxial GaAs with the use of magneto-optical spectroscopy ....See Entry 120035

Raman scattering resonant with quasi-two-dimensional excitons in semiconductor quantum wells ....See Entry 120080

Theory of coherence effects in time-dependent delayed fluorescence. II. Application to two- and three-dimensional crystals .... See Entry 120119

Singlet exciton migration in a random organic two-component system containing physical and chemical traps ....See Entry 120120

Bound-exciton luminescence of Cu-doped ZnSe .... See Entry 120123

Amorphous properties of excimer luminescence in poly(*N*-vinylcarbazole) films ....See Entry 120129

Relaxation processes of free excitons in KBr:Na ....See Entry 120131

Direct luminescence evidence for the degenerate electron-hole plasma formation in $A^{II}B^{VI}$ semiconductors ....See Entry 120140

The effect of rare-earth admixture on GaSe crystals radiation in the indirect transition ....See Entry 120152

Orientation dependence of core edges from anisotropic materials determined by inelastic scattering of fast electrons ....See Entry 120201

71.36 POLARITONS

(inc. photon-phonon and photon-magnon interactions)

119467 The role of polaritons in superconductivity phenomenon [metal-dielectric contacts]. D.Mirjanic (Technol. Faculty, Univ. of Banja Luka, Banja Luka, Yugoslavia), D.Hadziahmetovic.
Fizika (Yugoslavia), vol.15, no.3, p.225-31 (July-Sept. 1983).
Analysing the influence of electromagnetic waves on the magnitude of the superconductivity energy gap it was shown, that some increase can be reached if there is a sandwich between a semi-infinite metal and a semi-infinite dielectric with optical characteristics. It was predicted theoretically that the superconductive motion of electrons is possible at the temperatures of about 100-200K. This effect can be expected only for those electrons which are very close to dielectric part of the sandwich. (10 refs.)

119468 Effects of gaps on long range surface plasmon polaritons. G.I.Stegeman (Arizona Res. Labs., Univ. of Arizona, Tucson, AZ, USA), J.J.Burke.
J. Appl. Phys. (USA), vol.54, no.9, p.4841-3 (Sept. 1983).
The authors show that air gaps of 50 Å and less in a symmetric dielectric-metal film-dielectric structure lead to mode cutoff for long range surface plasmons. High index liquids are discussed as a solution to this problem for most cases. (7 refs.)

119469 The polariton soliton formation due to the effect of the dipole momentum saturation. G.D.Shibarshina, S.A.Moskalenko, P.I.Khadzhi (Inst. of Appl. Phys., Acad. of Sci., Kishinev, Moldavian SSR).
Phys. Status Solidi b (Germany), vol.119, no.1, p.153-8 (1 Sept. 1983).
The energy flux density of the incident light upon the crystal surface and the form of the wave packet envelope with frequencies lying in the exciton range of the spectrum are determined. They must be of such a nature that after the penetration into the semi-infinite crystal the laser pulse can travel at once as a solitary wave without any transient stage. In the case considered the effect of dipole momentum saturation (DMS) for the transition from the ground state of the crystal to that of the exciton is the main nonlinearity. The Maxwell-Fresnel boundary conditions are used on the interface between the vacuum and the crystal. (10 refs.)

119470 Conditions for formation of polariton-like solitons and transmission of an ultrashort light pulse across a crystal-vacuum interface. S.A.Moskalenko, P.I.Khadzhi, G.D.Shibarshina, A.Kh.Rotaru, F.N.Georgitsa (Inst. of Appl. Phys., Acad. of Sci., Kishinev, Moldavian SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.387-9 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.678-83 (March 1983). [received: Oct. 1983]
For frequencies in the exciton region of the spectrum, the light energy flux density incident on a crystal from vacuum is determined, and also the shape of the wave packet envelope, necessary for propagation as a soliton wave packet without an intermediate transitional stage, immediately after entering a semiinfinite sample. The principal properties of the wave packets, such as the energy flux density in vacuum, the exciton and photon component amplitudes for a soliton in a crystal, the refractive index and the reflectivity at the interface of the two media, are expressed in closed form in terms of the detuning from resonance between the soliton carrier-wave frequency and the limiting frequency of the transverse exciton. (18 refs.)

119471 Polariton excitations in gyrotropic crystals. A.N.Goncharuk, N.S.Tyu, S.A.Fedorov.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1338-42 (Sept. 1983). In Russian.
The theory of polaritons in molecular crystals is analyzed with regard to the space dispersion. Simple and convenient formulas are obtained for calculating coefficients of the canonical conversion of the exciton-photon Hamiltonian function. (8 refs.)

The temperature dependence of coherent two-photon processes in naphthalene in the strong exciton-photon coupling regime ....See Entry 118206

Instability of polaritons driven by infrared laser light ....See Entry 119121

71.38 POLARONS AND ELECTRON-PHONON INTERACTIONS

(for electron-phonon interactions in lattices, see also 63.20K)

119472 A theory for a self-trapped molecular magnetic polaron in ferromagnetic semiconductor. M.Takahashi, T.Kasuya (Dept. of Phys., Tohoku Univ., Sendai, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3127-37 (Sept. 1983).
Properties and stability conditions for a self-trapped molecular magnetic polaron in ferromagnetic semiconductors, in which two electrons are trapped in a self-induced localized spin polarization through the strong d-f exchange interaction, are investigated theoretically and in particular for EuO and EuS numerically. It is shown that the molecular magnetic polaron can be more stable than two single magnetic polarons near the Curie temperature if the material has many valley band structures and large dielectric constant. The dependences of the free energy of the molecular polaron as well as the single polaron on the effective electron mass, the Curie temperature and d-f exchange interaction were studied. The possibility of the molecular polaron in EuO and EuS is discussed. Effect of the anisotropic effective mass was also studied by the molecular field theory and it was shown that it is not important. (17 refs.)

119473 Effect of electron-phonon interaction in the magnetic polaron. M.Takahashi, T.Kasuya (Dept. of Phys., Tohoku Univ., Sendai, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3138-43 (Sept. 1983).
The effect of the electron-LO phonon interaction on the magnetic polaron in EuS and EuO is studied by the trial Hamiltonian method theoretically. It is shown that this effect stabilizes the magnetic polaron more by shrinking its radius. The stability regions of both the single and the molecular magnetic polarons become wider. However, the relative stability of the molecular polaron to the decomposed two single polarons does not change so much. (2 refs.)

119474 Polarons and solitons in trans-$(CH)_x$: an optical study. S.Etemad (Bell Labs., Whippany, NJ, USA), A.Feldblum, A.G.MacDiarmid, T.C.Chung, A.J.Heeger.
J. Phys. Colloq. (France), vol.44, no.C-3, p.413-22 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The absorption spectra of polaron and soliton excitations in trans-$(CH)_x$ have been characterized experimentally using the detailed quantitative studies of the near-ir-absorption during the electrochemical doping process. The quantitative agreement with the calculations of soliton mid-gap absorption is shown to be a direct evidence for the proposal that doping of trans-$(CH)_x$ predominantly proceeds through soliton formation. The intense δ-function transition between the two localized levels of a polaron is observed to give rise to a series of sharp ($\leq$0.1 eV wide) additional absorptions which the authors have used to monitor polaron concentration during the doping process. Consistent with the metastability of polarons in trans-$(CH)_x$, with a pair decaying into the lower energy soliton-antisoliton pair, polarons are found to be present only at very dilute doping levels. (21 refs.)

119475 Polarons in quasi-one-dimensional conducting polymers. A.R.Bishop, D.K.Campbell, K.Fesser (Theoretical Div., Center for Nonlinear Studies, Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.423-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Discusses several aspects of polaron excitations in quasi-one-dimensional conducting polymers. The authors review the structure of polarons in trans- and cis-$(CH)_x$, illustrate the relation of polarons in SSH-type models to conventional one-band polarons, and establish the existence and properties of polarons in conjugated diatomic polymers of the $(\bar{A}=B)_x$ type. (19 refs.)

119476 Soliton diffusion in polyacetylene. K.Maki (Phys. Dept., Univ. of Southern California, Los Angeles, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.485-9 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Making use of the Su, Schrieffer and Heeger (SSH) model (1979) for polyacetylene, the author studies theoretically the soliton diffusion in pristine trans-$(CH)_x$. The soliton in the SSH model couples linearly both optical and acoustic phonons. Since the coupling to the optical phonon is stronger, the optical phonon dominates the soliton diffusion in high temperature ($T>400K$). However, below the room temperature the acoustic phonon dominates the soliton diffusion. For temperature $T>T_0\equiv 2mc^2$, where m is the soliton mass and c is the acoustic phonon velocity, the soliton relaxation is determined by the single phonon process. This process results in the diffusion constant $D\propto T^{1/2(2-d)}$, where d is the dimensionality of the acoustic phonon. For $T<T_0$ the acoustic phonon process becomes inefficient. The results are compared with existing experiments on the diffusion constant. (13 refs.)

119477 Polaron formation near a mobility edge. M.H.Cohen, E.N.Economou, C.M.Soukoulis (Corporate Res. Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1202-5 (26 Sept. 1983).
By combining the Emin-Holstein scaling theory of polaron formation with the scaling theory of localization in disordered systems, the authors show that the nonuniform extended eigenstates above edge (responsible for the continuous drop of the mobility to zero) collapse to localized polarons as the electron-phonon interaction is turned on. (21 refs.)

119478 The theory of magnetic polarons in antiferromagnetic semiconductors. B.V.Egorov, B.B.Timofeev (Inst. of Metal Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Status Solidi b (Germany), vol.119, no.1, p.99-112 (1 Sept. 1983).
The electron states in antiferromagnetic semiconductors with large atomic spins S and an arbitrary relation between the band width ΔE and the spin-electron interaction A are considered. It is shown that in the mean-field approximation of atomic spins the spin-electron interaction in the case of $AS\geq\Delta E$ leads to essential transformations in the electron spectrum, while the interactions of electrons with the spin deviations from the average values (at $T=0$ with virtual magnons) leads to a polaron-type quasi-particle formation: the antiferromagnetic polaron (AFP). With the help of the diagram technique at $T=0$ the AFP Green function and its spectrum are obtained. (19 refs.)

Electron-phonon coupling in KCP ....See Entry 119136

Effects of off-diagonal disorder on soliton- and polaron-like states in trans-polyacetylene ....See Entry 119415

π electron delocalization in poly-(p-phenylene) (PPP), polyphenylene sulfide (PPS) and polyphenylene oxide (PPO) and AsF_5 doping of PPP ....See Entry 119417

New approach to the exciton-phonon problem ....See Entry 119461

The effect of impurities and electron-phonon interaction on the phase diagram of 1-D conductors ....See Entry 119483

Theoretical studies of the physics of charged defect formation in doped organic polymers: towards a coherent theoretical picture ....See Entry 119513

Effect of an isolated impurity on the electronic structure of $(CH)_x$ ....See Entry 119515

DC and microwave conductivity of $FeCl_3$-doped polyparaphenylene $(p\text{-}C_6H_4)_x$ ....See Entry 119561

Strong electron-phonon interaction in quasi-one-dimensional conductor $M_xV_2O_5$ systems ....See Entry 119589

The scattering of charge carriers in large electron-hole drops in germanium ....See Entry 119595

Polaron-soliton model for macroscopic conduction in doped polyacetylene ....See Entry 119605

Photoproduction of neutral versus charged solitons in trans $(CH)_x$ ....See Entry 119655

Electron spin resonance studies of magnetic defects in $FeCl_3$-doped polyparaphenylene $(p\text{-}C_6H_4)x$ ....See Entry 119916

The effect of vibronic transition on the interband optical-absorption in $(CH)_x$ ....See Entry 119999

Vibrational spectra and structure of undoped and doped polyparaphenylene ....See Entry 120066

71.45 COLLECTIVE EFFECTS

119479 Correlation functions of quasi-one-dimensional systems. A.A.Kovchinnikov, V.Ya.Krivnov (Inst. of Chem. Phys., Acad. of Sci., Moscow, USSR).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1513-18 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The correlation functions of one-dimensional Fermi-gas are found. At zero temperature the correlators at large distances decrease according to a power law, the exponent being a simple function of the velocity of sound. (11 refs.)

119480 Solitons in charge and spin density wave systems. B.Horovitz (Dept. of Nuclear Phys., Weizmann Inst. of Sci., Rehovot, Israel).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1519-23 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
A unified description of solitons in terms of two phases is presented and a counting rule for soliton charge and spin is derived. New types of solitons are found, in particular a spin density wave in an odd-order commensurate system must coexist with a charge density wave, and solitons then have an irrational spin component. (17 refs.)

119481 Electronic excitations in quasi one-dimensional dielectrics. S.Brazovskii, N.Kirova, V.Yakovenko (L.D. Landau Inst. for Theoretical Phys., Acad. of Sci., Moscow, USSR).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1525-30 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The theory of electronic excitations in quasi one-dimensional dielectrics of the Peierls type is discussed. The emphasis is made on the effects of potential (both strong and weak) and tunnel (weak) coupling and stability of electrons and solitons. (9 refs.)

119482 Charge ordering in 1-D molecular type crystals. D.Feinberg, J.Ranninger (Groupe des Transitions de Phases, CNRS, Grenoble, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1561-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
In a one-dimensional metal composed of stacked molecules, a strong coupling of the electrons to intramolecular deformations leads to an almost saturated CDW (charge density ordered state). The authors compare this instability to the classic Peierls instability. (4 refs.)

119483 The effect of impurities and electron-phonon interaction on the phase diagram of 1-D conductors. J.Solyom (Central Res. Inst. for Phys., Budapest, Hungary).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1565-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The phase boundaries of the 'g'-ology model are studied by using exact symmetry properties of the model. The effect of impurity scattering and retardation is also considered. (6 refs.)

119484 Dynamics of pinned charge density waves in $NbSe_3$. R.A.Klemm (Exxon Res. & Engng. Co., Linden, NJ, USA), J.R.Schrieffer, G.Gruner.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1689-92 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The model of Fukuyama and Lee for the pinning of charge density waves by impurities is investigated. The authors calculate the force-force correlation function, and find that the threshold electric field E_T is proportional to n_i^2. (3 refs.)

119485 Charge density wave domains in irradiated 1T-TaS_2: relation with the transport properties. H.Mutka (CEN, Fontenay-aux-Roses, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1713-15 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Electron microscopy observations show that lattice defects break the charge density wave into domains. The role of these domains in the electronic transport is discussed. (10 refs.)

119486 Stacking of charge-density waves in 1*T* transition-metal dichalcogenides. M.B.Walker, R.L.Withers (Dept. of Phys., Univ. of Toronto, Toronto, Canada).
Phys. Rev. B (USA), vol.28, no.5, p.2766-74 (1 Sept. 1983).
An extension of the McMillan (1975) and Nakanishi and Shiba (1977) models of charge-density-wave formation which fully reflects the space-group symmetry of the 1*T*-TaS_2 structure is presented. The model allows an incommensurate *c*-axis wave vector immediately below the normal to incommensurate transition temperature and a *c*-axis wave-vector lock-in transition at a lower temperature. The model also allows a number of different commensurate phases characterized by different charge-density-wave stacking configurations. A triple-honeycomb domain structure is described. (23 refs.)

119487 Influence of transverse motion quantization on the normal vibration spectrum of a two-dimensional Wigner lattice. V.M.Burdeinyi (Polytech. Inst., Vinnitsa, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.525-6 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.913015 (March 1983). [received: Oct. 1983]
The author computes the vibrational spectrum of a two dimensional electronic Wigner lattice with allowance for the quantum distribution of electron density in consequence of quantization of the motion perpendicular to the lattice. (7 refs.)

Chemistry and characterization of group V transition metal trichalcogenides ....See Entry 118982

Peierls instability and vibrational spectra of polyacetylene ....See Entry 119142

Doubled-incommensurate phase transition in quasione-dimensional systems ....See Entry 119154

Studies of structural transitions in TMA-TCNQ-I by high voltage electron diffraction ....See Entry 119177

Domain walls and their properties in quasi-one-dimensional crystals ....See Entry 119393

Analytic calculation of the charge distribution around the soliton in the 1D system ....See Entry 119394

Electronic structure of soliton-like excitation in 1-D conductors ....See Entry 119395

On the possibility of two phase transitions in HMTTF-TCNQ ....See Entry 119442

Charge density wave dynamics in the incommensurate and commensurate TaS_3 ....See Entry 119446

Electric field induced structural changes in $NbSe_3$? ....See Entry 119447

New results obtained by electron diffraction on the one-dimensional conductors TaS_3 and NbS_3 ....See Entry 119448

X-ray observation of 1-D precursor effects in $NbSe_3$ and new diffuse scattering features in $FeNb_3Se_{10}$ ....See Entry 119449

Switching and hysteresis in $NbSe_3$ ....See Entry 119450

Characterization of the CDW transition in orthorhombic TaS_3 by thermoelectric power and magnetic susceptibility measurements ....See Entry 119451

Effect of disorder on the charge density wave transitions and transport in orthorhombic TaS_3 .... See Entry 119452

Peierls transition in the quasi-one dimensional blue bronzes $K_{0.30}MoO_3$ and $RbO_{0.30}MoO_3$ .... See Entry 119453

Two CDW's locking model in orthorhombic TaS_3 .... See Entry 119454

Two-dimensional electron-hole system in a strong magnetic field .... See Entry 119464

Localization and interactions in a disordered electron gas .... See Entry 119517

Long range phase coherence in the current-carrying charge density wave state .... See Entry 119583

Charge density wave fluctuations in $TaSe_3$ and $NbSe_3$ .... See Entry 119585

Microwave harmonic mixing in $NbSe_3$ .... See Entry 119586

Influence of Mo- and Co-impurities on the non-Ohmic DC-conductivity in $NbSe_3$ .... See Entry 119587

AC conductivity of near-commensurate charge density waves—application to $NbSe_3$ and TaS_3 .... See Entry 119588

Solitons with adjustable charge in a commensurate Peierls insulator .... See Entry 119590

On the nonlinear field-effect of orthorhombic TaS_3 .... See Entry 119592

Theory of the narrow band noise spectrum and metastable conductivity due to sliding charge density waves .... See Entry 119677

The relaxation oscillator model for the narrow band noise in $NbSe_3$ .... See Entry 119678

The physics and applications of the two-dimensional electron gas .... See Entry 119707

Cyclotron anomaly in 2-D conductors .... See Entry 119917

The low-temperature optical properties of TTF-TCNQ in the far-infrared .... See Entry 120075

Positron annihilation as a probe of electronic density in the two-dimensional conductor 1T-TaS_2 .... See Entry 120176

71.45G Exchange, correlation, dielectric and magnetic functions, plasmons

119488 Correlation and disorder effects on the soliton states in a model polymer. S.Stafstrom, K.A.Chao (Dept. of Phys. & Measurement Technol., Univ. of Linkoping, Linkoping, Sweden).
J. Phys. C (GB), vol.16, no.28, p.L985-9 (10 Oct. 1983).
Assuming a single Slater determinant for the many-particle eigenfunction, an exact numerical solution for a chain of 60 molecules containing soliton states has been derived to study the electron correlation and disorder effect when both regular and stereo-irregular dimerised chains are considered. A profound influence due to the electron interaction is clearly demonstrated. (11 refs.)

119489 Multiple branches of acoustic plasma oscillations in thin wires. Y.C.Lee, S.E.Ulloa (Dept. of Phys. & Astron., State Univ. of New York at Buffalo, Amherst, NY, USA), P.S.Lee.
J. Phys. C (GB), vol.16, no.28, p.L995-1003 (10 Oct. 1983).
Multiple nonLandau-damped acoustic plasma modes are shown to exist for electrons in a slender wire. These slender acoustic plasmons (SAP) arise as a result of the collective, longitudinal oscillations of the electrons grouped in one of the discrete transverse-motion levels against those grouped in neighbouring levels. The authors present numerical examples of these (SAP) modes in GaAs, showing that they should be observable with the present techniques of thin semiconductor wire fabrication. In addition, another mode arising from the screened ion oscillations as modified by the slenderness of the wire is analysed. (14 refs.)

119490 Dielectric properties of polyacetylene. J.W.Mintmire, C.T.White, D.L.Peebles (Naval Res. Lab., Washington, DC, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.507-9 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors present a theoretical first-principles anisotropic dielectric function for all-trans polyacetylene. This dielectric function is shown to describe the 8-9 eV dielectric response peak measured using electron energy-loss spectroscopy. (7 refs.)

119491 Virtual surface plasmons in cylinders. S.S.Martinos (Dept. of Phys., Nuclear Res. Center Demokritos, Aghia Paraskevi, Athens, Greece), E.N.Economou.
Phys. Rev. B (USA), vol.28, no.6, p.3173-81 (15 Sept. 1983).
In a metallic cylinder virtual radiative surface eigenmodes with frequencies greater than plasma frequency exist; their dispersion curves and other properties are determined. The physical importance of these eigenmodes in the optical properties of metallic cylinders is shown. (13 refs.)

119492 Valence and core excitation spectra in K, Rb, and Cs alkali-metal stage-1 intercalated graphite. L.A.Grunes, J.J.Ritsko (Xerox Webster Res. Center, Webster, NY, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3439-46 (15 Sept. 1983).
Excitation spectra of the alkali-metal stage-1 intercalated graphites KC_8, RbC_8 and CsC_8 have been measured by high-resolution (0.1 eV) electron-energy-loss spectroscopy. The π intraband and interband plasmon excitations in the region below 10 eV are the same in all three compounds. However, in the valence region between 15 and 30 eV, small peaks are observed in RbC_8 and CsC_8 which are weaker than those previously observed in KC_8. In KC_8, these structures were identified as both excitations to the backfolded graphite bands created by the introduction of the intercalant and also as characteristic metal-atom core excitations. Within this interpretation, the weakening of the structure due to the backfolded bands with intercalant atomic number is consistent with weakening the coupling far above the Fermi level between the graphite and intercalant atoms. The carbon 1*s* core shell excitation at ~285 eV is also reported. The authors find that both the spectral shape and threshold energy are unaffected by the choice of alkali-metal intercalant (K, Rb, Cs), although the resulting spectrum differs from that of pristine graphite. Hence the graphite *p* states just above the Fermi level which are probed by the C 1s excitation are identically perturbed by the K, Rb, and Cs intercalations, suggesting that the degree of hybridization and charge transfer in these materials is the same. (19 refs.)

119493 Interchain Coulomb interactions in polyacetylene. S.Jeyadev (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3447-56 (15 Sept. 1983).
The difference in the π electron-electron interaction energy between charge-density waves in and out of phase on two parallel trans-polyacetylene chains is calculated up to second order in perturbation theory. It is found that this interaction favors the in-phase configuration, leading to a confinement potential when a soliton-antisoliton pair is present on the same chain. The confinement potential is found to go as $e^{-\pi d/a}/d^3\sqrt{\pi d/a}$, where d is the interchain separation and a the undimerized lattice spacing. The confinement potential is calculated to be 0.15K/site for a pair of chains. (14 refs.)

Degenerate four wave mixing with long range surface plasmons in attenuated total reflection geometries .... See Entry 118210

Determination of the parameters of diffraction channeling of electrons in single crystals from the backscattering energy spectra .... See Entry 119078

Local-density—functional approach to all-trans-polyacetylene .... See Entry 119396

Self-consistent scaling theory of the metal-insulator transition in disordered systems .... See Entry 119458

Effects of gaps on long range surface plasmon polaritons .... See Entry 119468

Effect of electron-mass anisotropy and effective dielectric function on the donor binding energies in silicon .... See Entry 119511

Anomalies in the optical and electrical properties of Cr-Al alloys .... See Entry 120005

Low-energy electron energy-loss spectra associated with reconstructed structure on Si (111) surface .... See Entry 120198

71.45N Calculations of total electronic binding energy

(see also 61.50L Crystal binding)

119494 Structural properties of III-V zinc-blende semiconductors under pressure. S.Froyen, M.L.Cohen (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3258-65 (15 Sept. 1983).
The pseudopotential method within the local-density approximation is used to investigate the static and structural properties of some III-V compound semiconductors. Comparisons of calculated total energies as a function of volume and structure yield information about solid-solid phase transformations. At high pressures the results indicate that several metallic structures are lower in energy than the zinc-blende structure. From the results the compounds (AlP, AlAs, GaP, and GaAs) can be devided into two classes. In the Ga compounds, the authors find a pressure-induced phase transformation to either rocksalt, β-Sn, or NiAs, whereas in the Al compounds rocksalt and NiAs are stabilized with respect to β-Sn. All structures except zinc blende are metallic. The authors discuss the electronic structure of each phase and show how it relates to structural stability. (30 refs.)

119495 Total energy of Al within the neutral-pseudoatom model. G.S.Sohoni, D.G.Kanhere (Dept. of Phys., Univ. of Poona, Poona, India).
Phys. Rev. B (USA), vol.28, no.6, p.3582-4 (15 Sept. 1983).
A simple scheme using a single-ion approach has been developed to calculate the total energy of simple metals within the neutral-pseudoatom model. The method has been applied to Al and the results of total energy and cohesive energy are reported. The individual components of the total energy are compared with the self-consistent calculation of Lam and Cohen (1981). The results indicate that the electron charge density in a simple metal such as Al is fairly well reproduced by the neutral-pseudoatom model. (11 refs.)

119496 Self-interaction correction for the Wannier representation of the uniform electron gas. M.R.Norman (Dept. of Phys., Tulane Univ., New Orleans, LA, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3585-6 (15 Sept. 1983).
The self-interaction correction (SIC) to the local-density approximation is evaluated for the total energy in the Wannier representation of plane waves and is found to be a small, but positive, number. This indicates that the delocalized plane waves are the correct solution of the SIC equations for a uniform electron gas, and thus this calculation provides a good consistency check on the SIC method. (5 refs.)

Local-density—functional approach to all-trans-polyacetylene .... See Entry 119396

71.50 LOCALIZED SINGLE-PARTICLE ELECTRONIC STATES

(exc. impurities; for localisation in disordered structures, see 71.55J)

119497 On the self-consistency of the one-parameter scaling theory of localisation. S.K.Sarker (Lab. of Atomic & Solid State Phys., Cornell Univ. Ithaca, NY, USA).
J. Phys. C (GB), vol.16, no.28, p.L991-4 (10 Oct. 1983).
The assumptions underlying the one-parameter scaling theory of localisation and their implications are examined in detail. In contrast to the conclusions reached by Kumar (see ibid., vol.16, p.L109, 1983), the theory is found to be self-consistent. (8 refs.)

119498 Onset of rare earth behavior in the actinides. J.L.Smith (Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.357 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
Summary form only given, as follows. In the rare earth elements almost the entire crossover from transition metal to localized f electron behavior occurs at cerium. In the actinides this behavior is spread out over uranium, neptunium and plutonium because of the more spatially extended 5f electrons. If applied pressure is included, there is completely equivalent behavior between the rare earths and the actinides with only a shift to heavier elements in the actinides. There are then parallels in such properties as superconductivity, magnetism and mixed valence. There are also tantalizing differences. For example some of the mixed valence behavior in samarium materials should occur in americium materials. Then the presence of one more f electron should simplify measurements of the mixed valent properties. The systematics of the actinides is compared with that of the rare earths. (2 refs.)

119499 Discrete intragap Pb states in $Pb_{1-x}Sr_xS$. M.A.Tamor, L.C.Davis, H.Holloway (Ford Motor Co., Dearborn, MI, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3320-3 (15 Sept. 1983).
The authors observe intragap Pb states in the alloy semiconductor $Pb_{1-x}Sr_xS$. Absorption spectroscopy shows that $Pb_{1-x}Sr_xS$ has an energy gap which decreases from 4.6 eV at $x=1$ to 0.4 eV at $x=0$. At very small Pb concentration ($x=0.993$) is a discrete absorption peak appears at 3.5 eV. As the Pb content is increased, this absorption grows in strength and a second peak appears at 3.2 eV. These peaks are ascribed to isolated Pb atoms and Pb dimers, respectively. When the samples are cooled to 80K the linewidths decrease by 40%. This improved definition reveals a third, very small absorp-

tion peak at 3.1 eV, possibly due to a Pb trimer. These results may be interpreted in terms of a simple tight-binding model that predicts an *s*-like impurity state above the valence band. This state is localized on the S atoms surrounding the Pb atom. Also, a *p*-like state due to the Pb 6*p* orbitals exists below the conduction band. Transitions from the *s* to the *p* state account for the impurity spectra. (12 refs.)

119500 Electron localization near a band edge and dielectric constant of TCNQ salts with strong structural disorder. A.A.Gogolin (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.6, p.1309-15 (Dec. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.6, p.2260-72 (Dec. 1982). [received: Oct. 1983]
Electron localization near a band edge in one-dimensional disordered systems is investigated at arbitrary values of the parameter $p_F l \sim 1$. The Berezinskii diagram technique is used. It is shown that near $p_F l$ the localization length l_{loc} and the static dielectric constant ϵ' decrease by one or two orders in a narrow interval of the parameter $p_F l$. this abrupt transition explains the temperature dependence of ϵ' in TCNQ salts with asymmetric cations. (17 refs.)

Electronic structure and bonding in transuranics: comparison with lanthanides ...... See Entry 119420

Metal-insulator transition and scaling for incommensurate systems ...... See Entry 119455

Valence and core excitation spectra in K, Rb, and Cs alkali-metal stage-1 intercalated graphite ...... See Entry 119492

Effects of 'weak' localization and of electron-electon interaction in thin copper and silver films ...... See Entry 119720

Spin-density calculations for core-electron photoemission and Auger electron line shapes, X-ray-edge exponents, and solid-state shifts ...... See Entry 120222

71.55 IMPURITY AND DEFECT LEVELS

119501 Application of generalized effective mass theory to some native point defects in $Hg_{1-x}Cd_xTe$. C.L.Wang, S.Wu, D.S.Pan (Electrical Engng. Dept., Univ. of California, Los Angeles, CA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1631-2 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
The authors have studied a few native defects in $Hg_{1-x}Cd_xTe$ in the effective mass approximation. For the case of mercury vacancy, which is of particular interest, this approach is quantitatively meaningful. The calculated levels for the neutrals and charged vacancies are reported. (8 refs.)

119502 Electronic properties of deep levels in *p*-type CdTe. R.T.Collins, T.C.McGill (California Inst. of Technol., Pasadena, CA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1633-6 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
DLTS and associated electrical measurements were made on unintentionally doped CdTe crystals obtained from several vendors, on Cu-doped CdTe, and on Te-annealed CdTe. All of the crystals were *p*-type. Four majority carrier deep levels were observed in the temperature range from 100-300K with activation energies relative to the valence band of 0.2, 0.41, 0.45, and 0.65 eV. Two of these levels were specific to certain crystals while the other two were seen in every sample and are attributed to common impurities or native defects. Fluctuations in the concentrations of levels across samples and as a result of modest sample heating (400K) were also observed. (12 refs.)

119503 Deep centers in gold-doped HgCdTe. C.A.Merilainen, C.E.Jones (Santa Barbara Res. Center, Goleta, CA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1637-40 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
Gold is a fast-diffusing acceptor in HgCdTe. It has been used as a *p*-type dopant and as a metal contact. This paper reports the presence of deep levels in gold-doped $x=0.48$ $Hg_{1-x}Cd_xTe$. Two types of spectra were observed; each had energy levels between $E_v+1/4E_{gap}$ and $E_v+1/2E_{gap}$. The capture cross sections for these centers have been determined and for most of the levels they involve small hole capture cross sections, 10^{-17} to 10^{-21} cm^2, and moderate electron capture cross sections, 10^{-15} to 10^{-16} cm^2. The hole capture cross sections for these centers had large negative activation energies indicative of hole capture at a positive center with a Coulomb repulsive barrier. The corresponding electron capture is then at Coulombically attractive positive centers. The situation described requires that the DLTS activation energies be corrected for the temperature dependence of the hole capture cross sections and for the Poole-Frenkel effect for electron capture. The energy levels and capture cross sections reported make these centers effective minority carrier recombination sites in *p*-type material. The minority carrier lifetimes measured are very close to those calculated for Shockley-Read recombination at the DLTS characterized centers. (7 refs.)

119504 Deep level Fourier spectroscopy: a new method to analyze deep levels in semiconductors. K.Ikeda, H.Takaoka.
Electr. Commun. Lab. Tech. J. (Japan), vol.32, no.6, p.1383-97 (1983). In Japanese.
A new technique has been developed for analyzing deep levels in semiconductors. In this technique, called Deep Level Fourier Spectroscopy (DLFS), the deep level emission rate is sequentially determined from various numerical calculations, by means of Fourier transforms for the transient capacitance values. This method makes it possible to analyze deep levels without having to determine spectral peaks. Computer simulation and experiments with p-type Si Schottky diodes are demonstrated. A comparison with the DLTS method proves that DLFS is an efficient and convenient method for evaluating deep levels. (14 refs.)

119505 Deep level transient spectroscopy evaluation of nonexponential transients in semiconductor alloys. P.Omling, L.Samuelson, H.G.Grimmeiss (Dept. of Solid State Phys., Univ. of Lund, Lund, Sweden).
J. Appl. Phys. (USA), vol.54, no.9, p.5117-22 (Sept. 1983).
Evaluation of data obtained from deep level transient spectroscopy (DLTS) is often based on the assumption that the transients are exponential. The applicability of DLTS to the study of deep energy levels in semiconductor alloys has therefore been questioned since thermal transients are often nonexponential in these materials. The authors present calculated DLTS spectra in a simple model for broadened defect levels. The calculated spectra are compared with experimental data for a deep electron trap in $GaAs_{1-x}P_x$. The main result is that, within the model, DLTS-deduced activation energies and thermal emission rates are, indeed, relevant even when the transients are strongly nonexponential as a result of alloy broadening. A method of estimating the corrected concentration of deep levels and the distribution in binding energies is also presented. (12 refs.)

119506 Application of the orthogonality theorem to the motion of a charged particle in metals. K.Yamada (Res. Inst. of Fundamental Phys., Kyoto Univ., Kyoto, Japan), A.Sakurai, M.Takeshige.
Prog. Theor. Phys. (Japan), vol.70, no.1, p.73-84 (July 1983).
An overlap integral between many-electron wave functions perturbed with local potentials at different sites is obtained in a closed form as a function of the phase shift and the distance between two impurities. The authors use the result to determine the reduction of the transfer motion of a charged particle in metals when screened by conduction electrons. The condition for the localization of the charged particle is derived. As an example, the two-*d*-hole bound state in resonant photoemission from transition metals is discussed. (6 refs.)

119507 Defect symmetry from stress transient spectroscopy. J.M.Meese, J.W.Farmer, C.D.Lamp (Res. Reactor Facility, Univ. of Missouri, Columbia, MO, USA).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1286-9 (3 Oct. 1983).
Uniaxial stress has been used with transient spectroscopy to study the level at E_c-0.17 eV in neutron-irradiated silicon. The defect symmetry, observed stress-induced electronic redistribution, and preferential stress-induced defect orientation have been determined and the reorientation activation energy has been measured. All of these effects are consistent with the A center. (10 refs.)

119508 Characterization of deep energy levels in mercuric iodide. T.Mohammed-Brahim (Lab. Cristaux et Couches Minces CEN, Alger, Algeria), A.Friant, J.Mellet.
Phys. Status Solidi a (Germany), vol.79, no.1, p.71-82 (Sept. 1983).
The past few years have seen an increasing interest in HgI_2 detectors for room temperature γ- and X-ray spectrometry. The performance and effective thickness of these detectors are presently limited by carrier trapping which results in incomplete charge collection. Characterization of the trapping levels is performed by several photoelectronic methods (photoconductivity, thermal and optical quenching of the photoconductivity, TSC, lifetime measurement). A model is proposed taking into account the results obtained by these techniques in both vapor phase and solution grown crystals. (39 refs.)

119509 Evidence for correlation effects in the hyperfine structure of the negative vacancy in silicon. M.Lannoo (Lab. de Phys. des Solides, Inst. Superieur d'Electronique du Nord, Lille, France).
Phys. Rev. B (USA), vol.28, no.5, p.2403-10 (1 Sept. 1983).
Recently published experimental data on the hyperfine structure of the negative vacancy in silicon are discussed. They contradict the prediction of one-electron theories that the contact terms of atoms lying in certain symmetry planes should vanish. A first possible explanation consisting of an inverted order of the one-electron levels is shown to require a much-too-large distortion coupling. The influence of many-electron effects is then worked out in some detail and shown to provide a correct order of magnitude for these contact terms when using parameters determined previously for V^0. This demonstrates (i) that a coherent picture of many-electron effects is obtained for the different charge states of the vacancy; (ii) that many-electron effects have little influence on the ground state, confirming Watkins's view that the Jahn-Teller effect dominates this state; and (iii) that the many-electron effects are indeed at the origin of these small nonvanishing contact terms. (12 refs.)

119510 Annealing of electron-induced defects in *n*-type germanium. P.M.Mooney, F.Poulin, J.C.Bourgoin (Groupe de Phys. des Solids, Ecole Normale Superieure, Univ. de Paris VII, Paris, France).
Phys. Rev. B (USA), vol.28, no.6, p.3372-7 (15 Sept. 1983).
n-type, 10^{13} and 2×10^{15} cm^{-3} doped germanium has been irradiated with $\sim$1-MeV electrons at liquid-helium and room temperatures. With the use of transient-capacitance spectroscopy, six electron traps and one hole trap were observed following irradiation at 4K. Their energy levels have been determined to be E_c-40, 120, 120, 260, 390, and 530 meV, and at E_v+250 meV. The isochronal annealing behavior of these traps, in addition to that of the four electron traps and of the four hole traps produced by room-temperature irradiation, has been studied in detail. Comparison of the results with previously published ones indicates that (i) the divacancy anneals around 150°C, and the *E* center around 100°C, (ii) the two levels at E_c-120 meV are associated with the germanium interstitial or complexes involving a germanium interstitial, and (iii) there appears to be a vacancy level in the range 100-200 meV from the conduction band, which anneals at $\sim$100K. (19 refs.)

119511 Effect of electron-mass anisotropy and effective dielectric function on the donor binding energies in silicon. A.Neethiulagarajan (Dept. of Phys., Virudhunagar Hindu Nadars' Senthikumara Nadar Coll., Virudhunagar, India), S.Balasubramanian.
Phys. Rev. B (USA), vol.28, no.6, p.3601-3 (15 Sept. 1983).
With the use of the Krieger-Nightingale model, the donor binding energy in Si is calculated variationally as a function of donor concentration. The impurity potential incorporates an effective dielectric function of the host and impurity electrons. The mass anisotropy of the electron is also included. The Mott constant, $aN_c^{1/3}$, obtained is compared with the earlier results. (10 refs.)

119512 Value of the signal of the double correlation DLTS method. A.Le Bloa (Groupe d'Electronique et de Phys. des Materiaux, Univ. de Rennes I, Rennes, France).
Rev. Phys. Appl. (France), vol.18, no.9, p.561-4 (Sept. 1983). In French.
The real signal of double correlation DLTS method is calculated; it is shown that it is necessary to use this signal to determine the characteristics of the defects. (6 refs.)

Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride ...... See Entry 116917

Indirect interaction in semiconductors ...... See Entry 119007

P_{Ga} antisite defect in Zn-implanted $GaAs_{0.1}P_{0.9}$ LED ...... See Entry 119016

Growth and photoluminescence spectra of high-purity liquid phase epitaxial $In_{0.53}Ga_{0.47}As$ ...... See Entry 119363

Characterizaiton of eptiaxial films of CdTe and CdS grown by hot-walled epitaxy ...... See Entry 119375

Dingle temperatures and Fermi surface changes in Cu(H): an application of the impurity cluster formalism ...... See Entry 119398

Electronic structure and X-ray near-edge core spectra of Cu_2O ...... See Entry 119433

Self-trapped exciton and rare-gas impurity centers in solid Ne ...... See Entry 119462

Solitons in bis-tetramethyltetraselenafulvalene hexafluorophosphate $[(TMTSF)_2PF_6]$ ...... See Entry 119566

Investigation of persistent photoconductivity in Si-doped *n*-$Al_xGa_{1-x}As$ grown by molecular beam epitaxy ...... See Entry 119643

Photoionization cross section of electron irradiation induced levels in silicon ...... See Entry 119648

Origin of the low electronic component of the electrical conductivity of solid electrolytes based on β-Al_2O_3 .... See Entry 119674

A new space-charge-limited-current diode theory with analysis of Cu_xS/CdS data .... See Entry 119697

Deep centers in semiconductor devices: mean lifetime control .... See Entry 119700

A new transient capacitance technique for the determination of interface traps in metal-oxide semiconductor transistors .... See Entry 119709

Energy concepts of insulator-semiconductor interface traps .. See Entry 119711

Isomeric and Knight shifts for a conductor with resonance states of electrons at defects .... See Entry 119966

Optical absorption edge in $Hg_{0.7}Cd_{0.3}Te$ .... See Entry 120002

Identification of residual donors in high-purity epitaxial GaAs with the use of magneto-optical spectroscopy .... See Entry 120035

Boron impurity anti-site defects in p-type gallium-rich gallium arsenide .... See Entry 120116

Study of two different deep levels in undoped LEC SI-GaAs by photoluminescence spectroscopy .... See Entry 120122

Bound-exciton luminescence of Cu-doped ZnSe .... See Entry 120123

Deep-level luminescence in Ni-diffused GaAs .... See Entry 120125

Low temperature photoluminescence of *n*-type GaInAsP layers grown on InP by liquid phase epitaxy .... See Entry 120127

Excitation and decay of H4 luminescence in diamond .... See Entry 120132

Photoluminescence decay in amorphous silicon alloys .... See Entry 120141

Dependence of photoluminescence on temperature in dislocated silicon crystals .... See Entry 120142

Energy transfer and luminescence in $RbMn_xMg_{1-x}F_3$ .... See Entry 120144

Radiative recombination with the participation of isoelectronic traps in solid solutions $In_{1-x}Ga_xP_{1-z}As_z$ doped with bismuth .... See Entry 120155

Thermoluminescence of thallium-doped BaFCl .... See Entry 120162

Trap-level spectroscopy using the 'nonequilibrium-phase-transition model' of thermally stimulated luminescence .... See Entry 120166

The field fluctuational model of thermally stimulated processes in ferroelectric $LiNbO_3$ .... See Entry 120167

Vacancy effects in the X-ray photoelectron spectra of TiN_x .See Entry 120223

71.55J Localization in disordered structures

119513 Theoretical studies of the physics of charged defect formation in doped organic polymers: towards a coherent theoretical picture. J.L.Bredas (Lab. de Chimie Theorique Appliquee, Facultes Univ. Notre-Dame de la Paix, Namur, Belgium), B.Themans, J.M.Andre, R.R.Chance, D.S.Boudreaux, R.Silbey.
J. Phys. Colloq. (France), vol.44, no.C-3, p.373-9 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
From Hartree-Fock self-consistent-field calculations on trans-polyacetylene, polyparaphenylene, and polypyrrole, a coherent theoretical description emerges for the physics of conducting doped organic polymers. The importance of the geometric modifications that occur on the polymer chains upon charge transfer is stressed. These modifications are shown to lead to the appearance of electronic states in the gap that play a major role in the conductivity mechanism. MNDO calculations on trans-polyacetylene chains indicate that the geometries of soliton or polaron defects vary significantly with their charge state. (22 refs.)

119514 Impurity-induced defect states in polyacetylene. D.Baeriswyl (Seminar fur Theoretische Phys., ETH-Honggerberg, Zurich, Switzerland).
J. Phys. Colloq. (France), vol.44, no.C-3, p.381-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The effect of impurities on both the electronic structure and the lattice distortions in polyacetylene is studied using the SSH Hamiltonian and an impurity potential acting on a single site. Assuming an ideally dimerized chain it is shown that the impurities lead to localized electronic states with energy levels tending to mid-gap and extents the impurity potential. Both the discrete and the continuum model yield the same result in the weak-coupling limit. The impurity-induced optical absorption is calculated and found to be weaker by a factor of about 4 than the soliton-induced absorption. Finally the modifications in the electronic structure are shown to lead to strong lattice relaxation, and it is concluded that the impurities affect both the electronic states and the displacement pattern of the lattice. (13 refs.)

119515 Effect of an isolated impurity on the electronic structure of $(CH)_x$. J.P.Albert, C.Jouanin (Groupe d'Etudes des Semiconducteurs, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.387-9 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The influence of the presence of an impurity lying near a $(CH)_x$ chain is studied on the polaron and soliton gap levels. (4 refs.)

119516 Singular spectra in one-dimensional random systems. T.A.L.Ziman (Inst. Laue-Langevin, Grenoble, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1555-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The author discusses the occurrence of singular densities of states in random one-dimensional Hamiltonians at exceptional energies for which eigenstates are localised more weakly than exponentially. Simple examples are given. (6 refs.)

119517 Localization and interactions in a disordered electron gas. M.Ma (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA), E.Fradkin.
Phys. Rev. B (USA), vol.28, no.6, p.2990-3006 (15 Sept. 1983).
The authors consider a model of N species of electrons in a random potential interacting via a short-range repulsive interaction. They study the $N=\infty$ limit and the $1/N$ expansion to the leading order in $1/N$. After renormalizing the theory, they find that there are three coupling constants in this problem: (i) a coupling constant with the dimensions of the resistivity, (ii) the coupling for electron-electron scattering, and (iii) the coupling strength between diffusive modes and density fluctuations. The renormalization-group equations are presented. In $2+\epsilon$ dimensions the Anderson fixed point of the noninteracting theory is shown to belong to a line of unstable fixed points. A new ('interacting') fixed point is found. At the transition they find that, to leading order in $1/N$, (a) the exponent ν of the localization length is the same as in the noninteracting theory, (b) the DC conductivity vanishes at the mobility edge with an exponent $s={}^2/_{17}$, (c) the density of states at the Fermi surface vanishes at the mobility edge with an exponent $\delta={}^2/_{17}$, (d) the mean free time τ at the Fermi surface vanishes at the mobility edge with an exponent $\zeta={}^7/_{17}$, (e) the Fermi velocity diverges at the mobility edge with an exponent $\rho={}^5/_{17}$, and (f) the diffusive modes acquire wave-function renormalization and the anomalous dimension η is (to leading order) equal to $\epsilon/34$. (30 refs.)

119518 Localized states and the electronic properties of a hydrogenated defect in amorphous silicon. D.P.DiVincenzo (Dept. of Electrical Engng., Univ. of Pennsylvania, Philadelphia, PA, USA), J.Bernholc, M.H.Brodsky.
Phys. Rev. B (USA), vol.28, no.6, p.3246-57 (15 Sept. 1983).
The authors study the electronic properties of a hydrogen-dressed silicon monovacancy as a model of H centers in hydrogenated amorphous silicon (*a*-Si:H). Using the self-consistent Green's-function technique they obtain total and local densities of states for the defect, as well as the charge density of defect eigenstates. The hydrogenated vacancy has no states in the band gap and reduces the Si host density of states at both the valence- and conduction-band edge. The Si-H bonding character of the defect eigenstates is greatest 4.5 eV below the valence-band edge; however, no sharp H-induced resonance occurs anywhere in the valence or conduction bands. The authors discuss the importance of including the self-consistent rearrangement of charge around the H atom in obtaining accurate results for the hydrogenated vacancy. Within the context of a recently proposed quantum-well model, they relate the results of their Green's-function calculation to the properties of *a*-Si:H. Using several simple models (percolation theory, the Anderson model, effective-mass theory), they obtain estimates for the valence- and conduction-band mobility edges. They find that the valence band is much more strongly affected than the conduction band by H disorder, and that H disorder is more important than dihedral-angle disorder in valence-band edge localization. (26 refs.)

Metal-insulator transition and scaling for incommensurate systems .... See Entry 119455

Polaron formation near a mobility edge .... See Entry 119477

Correlation and disorder effects on the soliton states in a model polymer .... See Entry 119488

Hopping conduction in lightly-doped polyacetylene .... See Entry 119557

Amorphous silicon-phosphorus layer .... See Entry 119613

Photoluminescence decay in amorphous silicon alloys .... See Entry 120141

71.70 LEVEL SPLITTING AND INTERACTIONS

(see also 75.10 – in magnetic phenomena, 75.30E Exchange and superexchange interactions, 73.20 Electronic surface states)

119519 Calculation of the charge transfer in ion-radical salts. L.Komorowski (Inst. of Organic & Phys. Chem., Tech. Univ. of Wroclaw, Wroclaw, Poland).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1211-13 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
A phenomenological method of calculation of the charge transfer in crystals has been derived from the density functional theory. Ionic charges in a broad selection of inorganic crystals and organic ion-radical salts have been reproduced. (9 refs.)

119520 Possibility of a distortion induced gap in intermediate valence compounds. B.R.Alascio, A.A.Aligia, C.A.Balseiro (Centro Atomico Bariloche, CNEA, Bariloche, Argentina).
Solid State Commun. (USA), vol.48, no.2, p.185-8 (Oct. 1983).
It is shown that in some stoichiometric intermediate valence compounds a symmetry breaking distortion leading to a hybridization gap in the electronic density of states can exist. The authors study this possibility for the high pressure phase of SmS and the paramagnetic phase of TmSe. (13 refs.)

119521 Mixed valence in $CeNi_5$; Effects of dilution and chemical pressure. S.Raaen, R.D.Parks (Dept. of Phys., Polytech. Inst. of New York, New York, NY, USA).
Solid State Commun. (USA), vol.48, no.2, p.199-202 (Oct. 1983).
X-ray L_{III} absorption measurements were employed to determine the (mixed) valence of the system $R_{0.9}Ce_{0.1}Ni_5$, where R=La, Pr, Gd, Er or Lu. The valences obtained spanned only the narrow range 3.13-3.16 in going from La to Lu, compared to 3.15 for the stoichiometric compound $CeNi_5$. These results establish the extreme insensitivity of the mixed valence of $CeNi_5$ to dilution effects, and, hence, that it is a local site phenomenon. Moreover, the valence is relatively insensitive to chemical pressure-induced lattice constant changes as large as 3 or 4%. (19 refs.)

119522 Destruction of the gap in the intermediate valence compound SmB_6 by neutron irradiation. J.Morillo, C.-H.de Novion (Section d'Etude des Solides Irradies, CEN, Fontenay-aux-Roses, France), J.Jun.
Solid State Commun. (USA), vol.48, no.4, p.315-19 (Oct. 1983).
The electrical resistivity ρ of a SmB_6 single crystal has been measured during and after a fast neutron irradiation performed at 21K: for the first time, it is shown that a very low defect concentration destroys the low temperature divergence of ρ in this compound. These results are considered as an evidence of the existence of an intrinsic gap in pure SmB_6, and of its destruction by point defects. On the contrary, the irradiation has increased the resistivity value at 300K, confirming the metallic character of SmB_6 at this temperature. The recovery of defects at 300K is very weak. (27 refs.)

119523 Exchange interaction and electron transport in mixed-valence clusters. M.I.Belinskii, B.S.Tsukerblat, N.V.Gerbeleu (Inst. of Chem., Acad. of Sci., Kishinev, Moldavian SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.497-8 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.869-71 (March 1983). [received: Oct. 1983]
The authors consider two transition metal ions (a and b) in octahedral positions with electron configurations d^1 and d^2 (Ti^{3+}-Ti^{2+}) having a common axis $C_4(z)$. The ground-state levels of the d^1 and d^2 ions in the crystal field are ${}^2T_2(t^2)$ and ${}^3T_1(t_2{}^2)$. The results represent a generalization of the Anderson-Hasegawa theory since they include a realistic structure of the crystal field levels, the effect of the degeneracy of multiplets, and also the effect of the interatomic exchange interaction in the theory of electron migration. (6 refs.)

119524 Many body theory of intermediate valence systems. S.M.Price. Univ. Nottingham, England thesis, 1983
The author considers the zero temperature magnetic susceptibility of an intermediate valence system calculated for two approximate methods. The band structure is discussed with special reference to Luttinger's Theorem. A many body perturbation theory is then used to investigate the properties of the ground state of such a system, and the problems involved in letting the number of particles interacting become large ($N \to \infty$) are considered.

Orientational order of spin probe molecules in liquid crystals .... See Entry 118878

Solid state chemistry of rare earth compounds with homogeneously and heterogeneously mixed valence .... See Entry 118974

The search for a trivalent thulium monotelluride .... See Entry 118975

Theoretical and experimental investigation of the optical properties of mixed-valence compound SmB_6 .... See Entry 119436

Onset of rare earth behavior in the actinides .... See Entry 119498

Theoretical studies of the physics of charged defect formation in doped organic polymers: towards a coherent theoretical picture .... See Entry 119513

The valency state of Ce in liquid Ni-Ce-alloys .... See Entry 119805

Plasma reflectance of the one-dimensional organic metals of the type $(arene)_2XF_6$(arene=perylene, pyrene or fluoranthene; X=P, As, Sb) .... See Entry 120073

Anomalous saturation of mixed valence in cerium-based systems as studied by X-ray absorption .... See Entry 120185

71.70C Crystal and ligand fields

119525 Interpretation of the optical and magnetic behaviours of $Pr_2Mg_3(NO_3)_{12}.24H_2O$. A.Nath (Magnetism Dept., Indian Assoc. for the Cultivation of Sci., Calcutta, India).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3244-7 (Sept. 1983).
The crystal field energy levels, the magnetic susceptibilities and the *g*-values of $Pr_2Mg_3(NO_3)_{12}.24H_2O$ were calculated theoretically by means of diagonalisation of the matrix of spin-orbit (SO), electrostatic (ES) and the crystal field (CF) interaction considered together, the matrix being constructed in a basis of all states of Pr^{3+} in the $4f^2$ configuration. A C_{3v} site has been assumed. The crystal field levels that were obtained from the aforesaid diagonalisation were used to calculate the *g*-values and principal magnetic susceptibilities. The set of parameters give a good fit to the three experiments (optical, EPR and susceptibility), and have been evaluated. (11 refs.)

119526 $(ReO_4)^{2-}$ ion in KCl: experimental evidence for a multimode intramolecular Jahn-Teller effect. H.Bill, Y.R.Sekhar (Groupe de Phys.-Chimie du Solide, Univ. de Geneve, Geneva, Switzerland).
Phys. Rev. B (USA), vol.28, no.5, p.2352-5 (1 Sept. 1983).
For the first time, experimental results have been obtained on a transition-metal tetroxy anion stabilised without any associated defects in a cubic crystal: the $(ReO_4)^{2-}$ ion in KCl. The authors' EPR study, including experiments under uniaxial stress and static electric fields applied to the crystal, shows that a strong and essentially intramolecular Jahn-Teller effect occurs but not exclusively of the $E \otimes \epsilon$ type. Appropriate linear combinations of the T_2 vibrations involving a pseudo-Jahn-Teller effect and spin-orbit coupling must play an important part. (16 refs.)

119527 Metal-ligand exchange effects and crystal field screening for rare-earth ions. L.I.Levin, V.I.Cherepanov (A.M. Gorki Ural State Univ., Sverdlovsk, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.394-9 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.692-9 (March 1983). [received: Oct. 1983]
The importance of various contributions to the screening of the second-rank crystal field for rare-earth ions as regards the interpretation of the experimental results is examined. An expression more accurate than previous ones is derived for exchange in the screening, and a number of these not discussed hitherto are disclosed. (35 refs.)

119528 Superposition-exchange model of the second-rank crystal field for rare-earth ions. L.I.Levin, V.I.Cherepanov (A.M. Gorki Ural State Univ., Sverdlovsk, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.399-403 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.700-7 (March 1983). [received: Oct. 1983]
A simple analytical expression is derived for several important contributions to the crystal field screening for rare-earth ions, arising from the allowance for metal-ligand exchange. The 'internal' parameters of the superposition model of the second-rank crystal field are calculated for the ion pair Tm^{2+}-F^- (ligand) in fluorites. (20 refs.)

Ln_2BaZnO_5 and $Ln_2BaZn_{1-x}Cu_xO_5$: A series of zinc oxides with zinc in pyramidal coordination .... See Entry 118978

Superhyperfine interactions of A_F centers in alkali halide crystals .... See Entry 119015

Theory of the structural phase transition in A15 compounds .... See Entry 119182

Heat capacity of a five-coordinated iron (III) complex, iodobis(*N,N*-dimethyldithiocarbamato) iron (III), between 0.4 and 300K .... See Entry 119216

Evidence for correlation effects in the hyperfine structure of the negative vacancy in silicon .... See Entry 119509

Exchange interaction and electron transport in mixed-valence clusters .... See Entry 119523

A theoretical analysis of electron Zeeman and hyperfine tensors for polyacetylene .... See Entry 119529

Magnetic behavior of Dy^{3+} ion in $Dy_2(SeO_4)_3.8H_2O$. Experimental and theoretical study including the effects of *J-J* mixing .... See Entry 119809

Mossbauer studies of the static and dynamic critical behavior of the layered antiferromagnets $RbFeF_4$ and $KFeF_4$ .... See Entry 119844

The isotropic hyperfine interaction in ternary complexes of copper(II) with 8-hydroxyquinoline and various salicyclic acids .... See Entry 119904

Paramagnetic resonance and optical absorption of Co^{4+} in $SrTiO_3$ .... See Entry 119905

Paramagnetic impurity centers in single crystals of synthetic xenotime .... See Entry 119908

Deuteron magnetic resonance study of single crystals of $NaDSeO_3$ .... See Entry 119924

Local boron environment in $Ni_{100-x}B_x$ metallic glasses: an NMR study .... See Entry 119931

First-principles theory of antishielding effects in the nuclear quadrupole interaction in ionic crystals: application to ^{57m}Fe in Fe_2O_3 .... See Entry 119949

Iron hyperfine field distribution in amorphous Fe-Ni-Cr-Mo-Si-B .... See Entry 119962

Atomic structure and magnetic properties of the pseudobinary alloys $Fe_3(Al, Si)$ .... See Entry 119963

Absorption edge of tin disulfide single crystals .... See Entry 120003

Infrared spectra at room and at low temperature of single crystals of 3(4-chlorophenyl)2-cyanopropenonitrile .... See Entry 120089

Water overtone and combination bands in the near-infrared spectrum of $M_2FeCl_5.H_2O$ (M=Cs,K) at cryogenic temperatures .... See Entry 120093

Influence of the crystal structure on the luminescence properties of rare earths .... See Entry 120134

Anisotropic ligand polarization contributions to the Laporte-forbidden transition probabilities of open-shell metal complexes .... See Entry 120139

Fluorescence spectra and crystal field analysis of rare earth oxyhalides and oxysulfates doped with trivalent europium and terbium .... See Entry 120154

Study of Cu K edge in some copper (II) octahedral complexes .... See Entry 120181

71.70E Spin-orbit coupling, Zeeman, Stark and strain splitting

119529 A theoretical analysis of electron Zeeman and hyperfine tensors for polyacetylene. M.T.Jones (Dept. of Chem., Univ. of Missouri, St. Louis, MO, USA), H.Thomann, H.Kim, L.R.Dalton, B.H.Robinson, Y.Tomkiewicz.
J. Phys. Colloq. (France), vol.44, no.C-3, p.455-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The components of the electron Zeeman tensors have been determined for randomly and partially oriented samples of polyacetylene and composites of polyacetylene by millimeter wave EPR spectroscopy. The complete ^{13}C and ^1H hyperfine tensors have been measured by ENDOR and TRIPLE resonance spectroscopy. While the experimental results are in qualitative agreement with the predictions of soliton theories in that a delocalized π-electron wave function is observed, the experimentally observed spin density variations along the polyene backbone are in qualitative and quantitative disagreement with the currently existing soliton theories. In contrast, EWMO and McLachlan molecular orbital calculations, based on the assumption that the paramagnetic entity being observed is an odd, linear, neutral, polyene radical, reproduce the experimental observations very well. (7 refs.)

Interpretation of the optical and magnetic behaviours of $Pr_2Mg_3(NO_3)_{12}.24H_2O$ .... See Entry 119525

$(ReO_4)^{2-}$ ion in KCl: experimental evidence for a multimode intramolecular Jahn-Teller effect .... See Entry 119526

Variational calculations on a quantum well in an electric field .... See Entry 119702

Physical interpretation of weak localization: a time-of-flight experiment with conduction electrons .... See Entry 119717

Magnetism of the heavy 5f elements .... See Entry 119798

Magnetic behavior of Dy^{3+} ion in $Dy_2(SeO_4)_3.8H_2O$. Experimental and theoretical study including the effects of *J-J* mixing .... See Entry 119809

Absorption edge of tin disulfide single crystals .... See Entry 120003

Two-photon interband absorption of light in semiconductors in external parallel electric and magnetic fields .... See Entry 120027

The low triplet state of tetramethyl-1,3-cyclobutanedithione. III. Single-crystal Zeeman spectroscopy .... See Entry 120031

Spin-orbit splitting of Γ exciton bands in RbI and KI .... See Entry 120032

Fluorescence spectra and crystal field analysis of rare earth oxyhalides and oxysulfates doped with trivalent europium and terbium .... See Entry 120154

71.70G Exchange interactions

119530 Application of a theory of special points to the calculation of a nonlocal exchange potential. I.I.Tupitsyn, R.A.Evarestov, V.A.Lovchikov (A.A. Zhdanov State Univ., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.355-7 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.625-9 (March 1983). [received: Oct. 1983]
The calculation of a nonlocal Hartree-Fock exchange potential in a crystal requires knowledge of the displaced (off-diagonal) first-order density matrix whose evaluation reduces to integration over the Brillouin zone. Direct application of quadrature formulas based on the theory of special points in the Brillouin zone can lead to a divergence in the exchange term of the Hartree-Fock operator. A theory of special points is generalized to rapidly oscillating functions of a wave vector and such generalization removes the aforementioned divergence. The present method is based on a weighting function which is introduced in the quadrature formula and this arbitrary weighting function is chosen to minimize the error in numerical integration over the Brillouin zone. (9 refs.)

Exchange interaction and electron transport in mixed-valence clusters .... See Entry 119523

Metal-ligand exchange effects and crystal field screening for rare-earth ions .... See Entry 119527

Superposition-exchange model of the second-rank crystal field for rare-earth ions .... See Entry 119528

Transverse magnetoresistance and Hall effect in wide-gap, p-type $Hg_{1-x}Mn_xTe$ .... See Entry 119632

The paramagnetic properties of Heusler alloys containing iron .... See Entry 119816

Plasma reflection and hole optical effective mass in p-HgTe .... See Entry 120082

71.70J Nuclear states and interactions

119531 **^{87}Rb electric field gradient tensors and the symmetry of the incommensurate phase in Rb_2ZnBr_4 and Rb_2ZnCl_4.** B.W.van Beest, A.Janner (Inst. for Theoretical Phys., Univ. of Nijmegen, Nijmegen, Netherlands), R.Blinc.
J. Phys. C (GB), vol.16, no.28, p.5409-16 (10 Oct. 1983).
The form of the Rb electric field gradient tensors observed in the incommensurate phases of Rb_2ZnBr_4 and Rb_2ZnCl_4 suggests that the superspace symmetry group of the incommensurate phase in these systems is $P_{ss\bar{1}}^{Pcmn}$. The incommensurate phase thus represents a modulation of the structure of the high-temperature phase and not a modulation of the structure of the low-temperature commensurate ferroelectric phase. The angular dependence of the $^{87}Rb\ {}^1/_2 \rightarrow -{}^1/_2$ NMR lineshape also suggests the above conclusion. (16 refs.)

119532 **Electric field gradients of Lu and Hf in Re.** E.Hagn, M.Zahn, E.Zech (Phys.-Dept., Tech. Univ. Munchen, Garching, Germany).
Phys. Rev. B (USA), vol.28, no.6, p.3130-7 (15 Sept. 1983).
The nuclear orientation technique has been applied to dilute ^{173}Lu ($j^\pi=7/2^+$; $T_{1/2}=1.37$ yr) and ^{175}Hf ($j^\pi=5/2^-$; $T_{1/2}=70$ d) nuclei in a hexagonal Re crystal, the activities being produced in situ via the nuclear compound reaction $^{185,187}Re(\alpha, xn\ \gamma p)$ at $E_\alpha=172.5$ MeV. From the γ-ray anisotropies at temperatures down to 8 mK the quadrupole interaction frequencies $\nu_Q=e^2qQ/h$ of $^{173}LuRe$ and $^{175}HfRe$ have been determined as $-1149(100)$ MHz and $-540(43)$ MHz, respectively. The electric field gradients (EFGs) are deduced to be $eq(LuRe)=-13.2(1.2)\times10^{17}$ V/cm^2 and $eq(HfRe)=-8.3(8)\times10^{17}$ V/cm^2. The negative sign in both cases indicates that the direction of the EFG at the impurity sites is uniquely fixed by the properties of the host lattice. The absolute magnitudes of these EFGs differ strongly from that of the pure system Re*Re*; they cannot be explained satisfactorily with any correlation known at present. (53 refs.)

Ln_2BaZnO_5 and $Ln_2BaZn_{1-x}Cu_xO_5$: A series of zinc oxides with zinc in pyramidal coordination ....See Entry 118978

Superhyperfine interactions of A_F centers in alkali halide crystals ....See Entry 119015

Heat capacity of a five-coordinated iron (III) complex, iodobis(*N,N*-dimethyldithiocarbamato) iron (III), between 0.4 and 300K ....See Entry 119216

Magnetic behavior of Dy^{3+} ion in $Dy_2(SeO_4)_3.8H_2O$. Experimental and theoretical study including the effects of *J-J* mixing ....See Entry 119809

Deuteron magnetic resonance study of single crystals of $NaDSeO_3$ ....See Entry 119924

Effect of tunnelling on the evolution of nuclear magnetisation ....See Entry 119945

Nonlinear effects in the electron-nuclear spin system of a semiconductor following absorption of light of variable circular polarization ....See Entry 119953

Temperature depedence of the electric field gradient in $AgIn_2$ intermetallic compound ....See Entry 119959

Nuclear level mixing resonances on low temperature oriented nuclei ....See Entry 119960

Iron hyperfine field distribution in amorphous Fe-Ni-Cr-Mo-Si-B ....See Entry 119962

Atomic structure and magnetic properties of the pseudobinary alloys $Fe_3(Al, Si)$ ....See Entry 119963

72.00 ELECTRONIC TRANSPORT IN CONDENSED MATTER

(for surfaces, interfaces, and thin films, see 73.)

72.10 THEORY OF ELECTRONIC TRANSPORT; SCATTERING MECHANISMS

119533 **Disordered-resistor network approach to the effective conductivity in inhomogeneous continua with substitutional disorder.** T.Nagatani (Coll. of Engng., Shizuoka Univ., Hamamatsu, Japan).
J. Appl. Phys. (USA), vol.54, no.9, p.5132-8 (Sept. 1983).
A disordered-resistor network model is presented to analyze the effective (or macroscopic) conductivity in the inhomogeneous continuum with a cellular-substitutional disorder, where the local conductivity g (**x**) varies randomly from cell to cell. The perturbation expansion for the lattice model is given to derive the effective conductivity from the statistical information about the random field g (**x**). The two-cell approximation taking into account pair configurations can be obtained from the partial sum of two-vertex terms by means of a diagrammatic representation of the perturbation series. The expression for the effective conductivity is presented up to the second-order term of the volume concentration c. This is also rederived from the different method, by solving problems involving two cells and averaging over all possible pair configurations. The coefficient of c^2 is numerically calculated for two models with the different pair configurations. The difference between pair configurations are clearly demonstrated by the present theoretical approach. It is shown that the calculated values agree with the experimental data of isotropic conducting paper into which square holes are punched at random. (57 refs.)

119534 **Hopping conduction in the *d*-dimensional lattice bond-percolation problem.** T.Odagaki, M.Lax, A.Puri (Dept. of Phys., City Univ. of New York, New York, NY, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2755-65 (1 Sept. 1983).
Hopping conduction of a bond-percolation model in *d*-dimensional lattices is studied by making use of the coherent-medium approximation. The DC conductivity vanishes when $p<p_c$ ($\equiv 2/z$) and is proportional to $p-p_c$ when $p\leq p_c$, where p is the probability that a given bond is not broken and z is the coordination number of the lattice. In the low frequency region, the leading term of the imaginary and real parts of the AD part of the conductivity are written as $A(z,d,p)f(\omega)$ and $B(z,d,p)g(\omega)$, respectively. It is shown that when $p<p_c$, $f(\omega)=\omega$ and $g(\omega)=\omega^2$, regardless of the dimensionality; at $p=p_c$, $f(\omega)=g(\omega)=\omega^{d/(d+2)}$ if $1<d<2$, $f(\omega)=g(\omega)=(-\omega\ln\omega)^{1/2}$ if $d=2$, and $f(\omega)=g(\omega)=\omega^{1/2}$ if $d>2$; when $p>p_c$, $f(\omega)=g(\omega)=\omega^{d/2}$ if $1<d<2$, $f(\omega)=-\omega\ln\omega$ and $g(\omega)=\omega$ if $d=2$, $f(\omega)=\omega$ and $g(\omega)=\omega^{d/2}$ if $2<d<4$, $f(\omega)=\omega$ and $g(\omega)=-\omega^2\ln\omega$ if $d=4$, and $f(\omega)=\omega$ and $g(\omega)=\omega^2$ if $d>4$. The coefficients $A(z,d,p)$ and $B(z,d,p)$ exhibit critical behavior in d at $d=1$, 2, and 4, and in p at $p=p_c$. For $p\gtrsim p_c$, $A(z,d,p)$ behaves as $(p-p_c)^{-\mu(d)}$ and $B(z,d,p)$ behaves as $(p-p_c)^{-\nu(d)}$. Here $\mu(d)=d/2$ for $1\leq d\leq 2$ and $\mu(d)=1$ for $d\geq 2$; $\nu(d)=d/2$ for $1<d\leq 4$ and $\nu(d)=3$ for $d>4$. For $p\lesssim p_c$, and $d\neq 2$, $A(z,d,p)$ behaves as $(p_c-p)^{-\mu'(d)}$ and $B(z,d,p)$ behaves as $(p_c-p)^{-\nu'(d)}$ where $\mu'(d)=2/d$ for $1\leq d<2$, $\mu'(d)=1$ for $d>2$; $\nu'(d)=4$ for $d=1$, $\nu'(d)=1+4/d$ for $1<d<2$, $\nu'(d)=3$ for $d>2$. For $d=2$, and $p<p_c$, A and B have a logarithmic dependence on p_c-p. Strong and weak criteria of localization are defined. It is suggested that the strong localization is always absent when $p\leq p_c$ and localization in the weak sense takes place even when $p_c<p\leq 1$ if $d\leq 2$. (40 refs.)

119535 **Unified theory of AC and DC hopping conductivity in disordered systems.** S.Summerfield.
Univ. Warwick, England thesis, Sept. 1982
The theory of electron transport via hopping between localised states is developed within the framework of the rate equation approach and in particular the a.c. and d.c. conductivity and Hall mobility are considered. The existence of substantial experimental data on the a.c. and d.c. conductivities motivates the development of a unified theory for these quantities. The conductivity problem has two congruent representations; either a single particle random walk on a random lattice or an equivalent electrical circuit may be considered. In this work the author examines both approaches and compares and contrasts the methods used. Previous unified theories were exclusively based on the random walk approach and methods for evaluating the associated average Green's function; these methods are critically reviewed and extended. The equivalent circuit approach is then examined and a new theory is formulated which is simple to develop and yields improved results which agree well with asymptotic formulae and computer simulation data. Experimental data on a variety of systems is analysed Finally the hopping Hall effect is considered.

72.15 ELECTRONIC CONDUCTION IN METALS AND ALLOYS

119536 **Metallic conductivity of copper phthalocyanine—carbon black composites.** W.Waclawek, M.Kulesza, M.Zabkowska (Pedagogical Univ., Czestochowa, Poland).
J. Phys. Colloq. (France), vol.44, no.C-3, p.673-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Electrical conductivity and thermoelectric power for copper phthalocyanine—carbon black composites were measured. For some composites metallic behaviour was found. (9 refs.)

119537 **Electrical and structural properties of a new conducting polymer: pyrolytic poly (*p*-phenylene-1,3,4-oxadiazole).** M.Murakami, H.Yasujima, Y.Yumoto, S.Mizogami, S.Yoshimura (Res. Dev. Corp. of Japan, Kawasaki, Japan).
J. Phys. Colloq. (France), vol.44, no.C-3, p.705-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Poly (*p*-phenylene-1,3,4-oxadiazole) films are pyrolyzed at various temperatures and their electrical and structural properties were investigated. The pyrolyzed films were composed of both extended eletronic states which contribute to a temperature-independent metallic conductivity (up to 510 S/cm) and localized states giving rise to a variable range hopping motion of electrons. The structure was thought to be a graphite-like crystal having condensed aromatic layers with nitrogen-containing heterocyclic rings. (12 refs.)

119538 **Ionic limit in graphite-fluoroarsenate intercalation compounds.** J.E.Fischer (Moore School of Electrical Engng., Univ. of Pennsylvania, Philadelphia, PA, USA), J.Milliken.
J. Phys. Colloq. (France), vol.44, no.C-3, p.723-7 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Measurements of electrical conductivity, optical reflectance and F_2-uptake suggest an ionic limit around C_{20} in graphite-fluoroarsenate compounds. Oxidation beyond this limit introduces carrier scattering centers in the form of covalent C-F bonds as deduced from measurements of conductivity versus temperature and XPS. (11 refs.)

119539 **Synthesis and physical properties of dimethyl trimethylene tetrathia-fulvalenium salts.** P.Delhaes, E.Dupart, J.Amiell, C.Coulon (Centre de Recherche Paul Pascal, Univ. de Bordeaux I, Talence, France), J.M.Fabre, L.Giral, D.Chasseau, B.Gallois.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1239-42 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
This work is devoted to an unsymmetrical substituted TTF: the dimethyl-4-5 trimethylene 4′5′ tetrathiafulvalene (DMtTTF) which has been synthetized. A new series of radical cation salts have been prepared by electrochemistry $DMtTTF_2$-X′ (X′=ClO_4, BF_4^-, PF_6^-). These materials are isomorphous with the TMTTF salts; they exhibit a metallic DC electrical conductivity below room temperature ($\sigma_{RT}=60$-$100\ \Omega^{-1}\ cm^{-1}$). From EPR investigation the onset of an antiferromagnetic state is detected around 10K. (8 refs.)

119540 **New conducting iron complexes derived from the 1,3-dithiol-2-thion-4,5-dithiolate ligand $(DMIT)^{2-}$.** F.Kubel, J.Strahle (Inst. fur Anorganische Chem., Univ. Tubingen, Tubingen, Germany), P.Cassoux.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1265-7 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Partial oxidation of the square planar complex Fe $(dmit)_2^-NBu_4^+$ yields metal organic complexes with high conductivity in the range of $10^{-2}\ \Omega^{-1}$ cm^{-1}. The oxidation can be carried out by chemical or electrochemical methods. The formation of a π-donor acceptor complex with TTF leads to highly conductive compounds, as well. By the reaction of the oxidized product with pyrazine a conducting polymeric compound is formed, in which pyrazine acts as a bridging ligand. (12 refs.)

Analogies between graphite intercalation compounds and doped polyacetylenes ....See Entry 118913

Electrocrystallisation and physical properties of dimethyltetrathia-fulvalenium salts ....See Entry 118998

Characterization of the CDW transition in orthorhombic TaS_3 by thermoelectric power and magnetic susceptibility measurements ....See Entry 119451

Destruction of the gap in the intermediate valence compound SmB_6 by neutron irradiation ....See Entry 119522

72.15C Electrical and thermal conduction in amorphous and liquid metals and alloys

119541 On the applicability of the nearly free electron model to resistivity calculations for liquid metals. J.Gorecki (Internat. Centre for Theoretical Phys., Trieste, Italy), J.Popielawski.
J. Phys. F (GB), vol.13, no.10, p.2107-14 (Oct. 1983).
Resistivity calculations based on the nearly free electron model are presented for many noble and transition liquid metals. The triple-ion correlation is included in the resistivity formula according to the self-consistent quasi-crystalline approximation (SCQCA). Two different methods for describing the conduction band are used. The problem of applicability of the nearly free electron model to different metals is discussed. (18 refs.)

119542 Electronic properties of Cu-Ti metallic glasses. U.Mizutani (Dept. of Crystalline Materials Sci., Nagoya Univ., Nagoya, Japan), N.Akutsu, T.Mizoguchi.
J. Phys. F (GB), vol.13, no.10, p.2127-36 (Oct. 1983).
The electronic properties of $Cu_{1-x}Ti_x$ metallic glasses ($x=0.4$, 0.5 and 0.6) have been studied through measurements of the low-temperature specific heat, the magnetic susceptibility and the electrical resistivity. The electronic specific heat coefficient increases with increasing Ti content. This behaviour is consistent with the UPS results and indicates the dominant contribution of the Ti 3d states at E_F. The magnetic susceptibility of the amorphous phase is temperature independent and is of the order of 10^{-4} EMU $mol.^{-1}$. It also increases with increasing Ti content. The presence of a large orbital paramagnetism is deduced and attributed to the unfilled d states at E_F. The electrical resistivity increases with decreasing temperature for all alloys studied. The Ziman theory cannot be applied for such highly resistive alloys. The low-temperature resistivity below 100K does not fit to the relation $\rho=\rho_0-AT^2$ ($A>0$), suggesting that an extra scattering mechanism is present and supersedes the effect due to the temperature dependence of the Debye-Waller factor. (24 refs.)

119543 Electrical, optical and glass transformation properties of amorphous solids—a review. C.A.Majid (Pakistan Inst. of Nuclear Sci. & Technol., Rawalpindi, Pakistan).
Nucleus (Pakistan), vol.20, no.1, p.23-35 (Jan.-March 1983). [received: Oct. 1983]
In this paper electrical conduction, photoconduction and optical absorption in amorphous solids are reviewed. A significance of the energy band-gap concept as applied to these solids is discussed. A method of obtaining this parameter from the electrical conductivity, photoconductivity and the optical absorption measurements is given. Different energy band models used to describe the electrical behaviour of these solids are also reviewed. The behaviour of an amorphous solid toward electrical contacts is discussed. A brief description of the glass transformation phenomenon is also given. (63 refs.)

Electronic states and conductivity in liquid and amorphous Fe .... See Entry 119407

Electronic properties of $Ca_{1-x}Al_x$ metallic glasses .... See Entry 119547

The valency state of Ce in liquid Ni-Ce-alloys .... See Entry 119805

72.15E Electrical and thermal conduction in crystalline metals and alloys

119544 Deviations from Matthiessen's rule in the nickel-chromium system. Y.D.Yao (Inst. of Phys., Acad. Sinica, Taipeh, Taiwan), S.Arajs, E.E.Anderson.
Phys. Status Solidi a (Germany), vol.79, no.1, p.327-30 (Sept. 1983).
The deviations from Matthiessen's rule are studied between 4 and 300K for Ni-Cr alloys containing Cr up to 27 at.%. For Ni=Cr alloys with Cr concentration smaller than about 5 at.%, the deviations from Matthiessen's rule of the resistivity can be explained by a two-current model. However, this model is not valid for Ni-Cr with Cr concentration larger than about 11 at.%. (18 refs.)

119545 Charge transport study on single crystals of β-LiAl. T.Asai, M.Hiratani, S.Kawai (Inst. of Sci. & Industrial Res., Osaka Univ., Ibaraki, Japan).
Solid State Commun. (USA), vol.48, no.2, p.173-6 (Oct. 1983).
Charge transport properties of β-LiAl were studied in the composition range of 48.0-50.2 at.%Li. Measurements were made on single crystal samples and down to the liquid He temperature. The resistivity changes linearly with temperature above 125K, with a thermal coefficient of 72-95 nΩ cm K^{-1}. The Matthiessen law was obeyed very well. A component dependent on temperature, which was described by the Gruneisen formula is insensitive to a change of the chemical composition. On the other hand, the residual resistivity depends largely on the composition and contributes up to 58% of the total resistivity in $Li_{0.502}Al_{0.498}$. It is chiefly due to the substituted Li atoms on the Al sublattice. (13 refs.)

Nondiffusion penetration of low-frequency electromagnetic waves into bismuth .... See Entry 119551

Electrical conductivity of non-homogeneous Au films on glass .... See Entry 119719

Instabilities in the superconductivity and the resistivity of implanted $Pd_{1-y}Cu_yH_x$ thin layers .... See Entry 119751

Atomic structure and magnetic properties of the pseudobinary alloys Fe_3(Al, Si) .... See Entry 119963

Anomalies in the optical and electrical properties of Cr-Al alloys .... See Entry 120005

72.15G Galvanomagnetic and other magnetotransport effects

119546 Extraordinary Hall resistivity in amorphous terbium-iron thin films and its temperature dependence. R.Malmhall (Xerox Palo Alto Res. Center, Palo Alto, CA, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5128-31 (Sept. 1983).
Measurements of the extraordinary Hall effect are performed as a function of temperature for amorphous Tb-Fe thin films of compositions close to 21 and 25 at.% Tb. The experimental results indicate that the Fe sublattice gives the dominant contribution to the extraordinary Hall effect. (24 refs.)

119547 Electronic properties of $Ca_{1-x}Al_x$ metallic glasses. U.Mizutani (Dept. of Crystalline Materials Sci., Nagoya Univ., Nagoya, Japan), T.Matsuda.
J. Phys. F (GB), vol.13, no.10, p.2115-25 (Oct. 1983).
The electronic properties have been studied of four $Ca_{1-x}Al_x$ metallic glasses ($x=0.25$, 0.30, 0.35 and 0.40) prepared by liquid quenching. The measurements involved are the electrical resistivity in the range 2-700K, the Hall coefficient at 77-300K, the low-temperature specific heat at 1.5-6K and the magnetic susceptibility at 77-600K. All experimental data indicate a non-free-electron behaviour. The effective electron concentration and the Fermi momentum are deduced from the Hall coefficient and found to be far below the free-electron values. Both the electronic specific heat coefficient and the magnetic susceptibility decrease with increasing Al content. The relatively large paramagnetism suggests the presence of d-character states at the Fermi level. The electrical resistivity is empirically found to obey the relation $\rho=\rho_0-BT^{1.2}(B>0)$ below 120K and to be proportional to temperature with a negative TCR in the range 120-400K. (15 refs.)

119548 Hall effect in Ni-rich $Fe_xNi_{80-x}B_{18}Si_2$ amorphous alloys. J.Ivkov, Z.Marohnic, E.Babic, M.Miljak (Inst. of Phys., Zagreb Univ., Zagreb, Yugoslavia), H.H.Liebermann.
J. Phys. F (GB), vol.13, no.10, p.2137-45 (Oct. 1983).
The Hall resistivity of amorphous $Fe_xNi_{80-x}B_{18}Si_2$ alloys ($x=0$, 5, 8, 10, 12 and 15) has been measured in the paramagnetic region. Except for $x=0$ these alloys are ferromagnetic with Curie temperatures $T_C \leq 316K$. For the separation of the normal and anomalous Hall coefficients the authors also measured the field and temperature dependence of the magnetisation in the corresponding temperature interval. The normal Hall coefficient $R_0=-(1\pm0.1)\times10^{-10}$ m^3 A^{-1} s^{-1} was roughly independent of x. The anomalous Hall coefficient R_s was positive, a factor of one hundred bigger, and it increased with x. The results for R_0 and R_s are compared with those for similar systems and discussed in terms of the recent theoretical models. (18 refs.)

119549 Correlation between magnetoresistance and magnetization in *Ag*Mn and *Au*Mn spin-glasses. A.K.Majumdar (Inst. fur Angewandte Kernphys., KFA Karlsruhe, Karlsruhe, Germany).
Phys. Rev. B (USA), vol.28, no.5, p.2750-4 (1 Sept. 1983).
Magnetization has been measured between 2 and 77K and mostly up to fields of 20 kOe in *Ag*Mn (1.1 and 5.4 at.%) and *Au*Mn (1.8 and 4.6 at.%) spin-glass samples where the transverse magnetoresistance was measured earlier. It is found, for the first time, that over a wide range of temperature and magnetic field the negative magnetoresistance varies as the square of the bulk magnetization resulting in an universal curve in the spin-glass regime. The constant of proportionality is independent of the Mn concentration. A theroetical justification is provided in terms of existing theories. (13 refs.)

119550 Application of the Pippard-Klemens-Jackson theory of longitudinal magnetoresistance to a model of scattering on the Fermi surface of copper, silver, and gold. L.Dallaire, J.Destry (Dept. de Phys., Univ. de Montreal, Montreal, Quebec, Canada).
Phys. Rev. B (USA), vol.28, no.6, p.2947-56 (15 Sept. 1983).
The authors present the results of a calculation of ρ_∞/ρ_0 (the ratio of the electrical resistivity in the saturation regime to the zero-field value) as a function of temperature in the range 0-40K, in the approximation of the small-angle scattering model. A mechanism is introduced whereby electrons (which would otherwise be scattered at the intersection of the Fermi surface with the Brillouin-zone boundary) avoid such scattering. This reduces the magnetosresistance from its value in the absence of this mechanism. They find that their values of ρ_∞/ρ_0 are very close to those measured by Powell et al. (Phys. Kondens. Mater. 9, 104, 1969) for the (100) and (110) orientations in copper, and in good agreement with unpublished data on the (111) orientation by the same authors. Finally, using their model they calculate values of ρ_∞/ρ_0 versus temperature in the range 0-40K, for silver and for fold, for the (100), (110), and (111) orientations. (9 refs.)

119551 Nondiffusion penetration of low-frequency electromagnetic waves into bismuth. V.T.Dolgopolov, P.N.Chuprov (Inst. of Solid-State Phys., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.6, p.1325-30 (Dec. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.6, p.2287-95 (Dec. 1982). [received: Oct. 1983]
An experimental study was made of the penetration of a large-amplitude low-frequency alternating field into the interior of bismuth single crystals at helium temperatures. It was found that inside the metal a wave had a sharp front and the sign of the magnetic field changed across the front. Such a wave traveled without significant damping over distances considerably greater than the skin layer depth. The shape of the wave front was influenced by the effects of a nonlocal coupling between the electrical field and the current; moreover, a magnetic field gradient influenced the conductivity of the compensated metal. (8 refs.)

The Bechgaard salts: magnetotransport, dimensionality, spin density waves and the threshold field .... See Entry 119563

Solitons in bis-tetramethyltetraselenafulvalene hexafluorophosphate [$(TMTSF)_2PF_6$] .... See Entry 119566

Relationship between Faraday rotation and Hall effect in amorphous rare-earth-transition-metal alloys .... See Entry 120034

72.15J Thermoelectric effects

Solitons in bis-tetramethyltetraselenafulvalene hexafluorophosphate [$(TMTSF)_2PF_6$] .... See Entry 119566

Electric conductivity and thermopower of quasi one-dimensional $(perylene)_2(AsF_6)_{0.75}(PF_6)_{0.35}.0.85CH_2Cl_2$ crystals .... See Entry 119582

72.15L Relaxation times and mean free paths

Theory of anomalous acoustical skin effect in metals .... See Entry 119666

72.15N Collective modes, e.g. in one-dimensional conductors

119552 Doping of polyacetylene films to the metallic state with $PtCl_4$ and $H_2PtCl_6.6H_2O$. Y.Cao, K.Guo, M.Wan, P.Wang, R.Qian (Inst. of Chem., Acad. Sinica, Beijing, China), F.Wang, X.Zhao.
Polym. Commun. (GB), vol.24, no.10, p.300-2 (Oct. 1983).
Polyacetylene has been doped with $PtCl_4$ and $H_2PtCl_6.H_2O$ to form an electrically conductive complex. It is shown that doped films can reach the metallic level, as evidenced by voltage-short compaction (VSC) measurement. Preliminary X-ray photoelectron spectroscopy (XPS) results show that, upon doping, oxidation of the polyacetylene chain is accompanied by a partial reduc-

tion of Pt^{4+} to Pt^{2+} and the dopant anion is a $PtCl_6^{2-}$ for both $PtCl_4$ and $H_2PtCl_6.6H_2$ doped $(CH)_x$. (10 refs.)

119553 Coordinated study of nearly metallic polyacetylene: role of solitons. A.J.Epstein, H.Rommelmann, R.Bigelow, H.W.Gibson, D.M.Hoffman, D.B.Tanner (Xerox Webster Res. Center-W114, Webster, NY, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.61-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Reports the results of a coordinated study of the structural, optical, magnetic and transport properties of cis and trans polyacetylene slow doped with iodine to nearly metallic levels, i.e. $[CH(I_3)_y]_x$, $1.0<y<5.0$. Cis and trans doped material have similar structure, with essentially all charges going into soliton states. The data are shown to be in agreement with a new mechanism of charge transport in polyacetylene, variable range hopping among soliton-like levels. (29 refs.)

119554 Polyacetylene: the search for solitons. S.Roth, K.Ehinger, K.Menke, M.Peo, R.J.Schweizer (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
J. Phys. Colloq. (France), vol.44, no.C-3, p.69-76 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Electric, magnetic and optical experiments on polyacetylene are reviewed and new data are presented concerning Raman studies of the AsF_5-induced isomerisation of cis samples, ESR results implying the coexistence of localized and itinerant spins even in slowly doped films at all doping levels, and time-resolved photoresponse of trans-polyacetylene in the nsec regime. It is argued that at present there is still very little direct experimental evidence for soliton motion in polyacetylene. (38 refs.)

119555 Doping of $(CH)_x$ films with metal penta- and hexafluorides. H.Selig, J.H.Holloway, A.Pron, D.Billaud (Hebrew Univ., Jerusalem, Israel).
J. Phys. Colloq. (France), vol.44, no.C-3, p.179-82 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Conductivity measurements have shown that exposure of polyacetylene films to the vapours of metal hexafluorides and pentafluorides causes them to be doped to the metallic state. Inverse correlations exist between the maximum conductivities attainable and the electron affinities of the hexafluorides or the fluoride ion affinities of the pentafluorides. (13 refs.)

119556 Depinning of charge carriers in n-type semiconducting polyacetylene. J.J.Andre, M.Bernard, B.Francois, C.Mathis (Centre de Recherches sur les Macromolecules, Strasbourg, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.199-202 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The solvation of cations has been used to show experimentally the importance of the binding energy between ionic impurities and charge carriers on the mechanisms of conductivity. Moreover spin carriers appear to interact with the charge carriers either by a binding energy (polaron) or by an exchange term (intersoliton hopping). (9 refs.)

119557 Hopping conduction in lightly-doped polyacetylene. D.Emin (Sandia Nat. Labs., Albuquerque, NM, USA), K.L.Ngai.
J. Phys. Colloq. (France), vol.44, no.C-3, p.471-5 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The charge transport in lightly doped polyacetylene involves severely localized electronic states which are strongly coupled to the atomic motion. (16 refs.)

119558 Dopant flexibility and processability studies with electrically conductive, face-to-face metallomacrocyclic polymers. T.Inabe (Dept. of Chem., Northwestern Univ., Evanston, IL, USA), J.W.Lyding, M.K.Moguel, T.J.Marks.
J. Phys. Colloq. (France), vol.44, no.C-3, p.625-31 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
In doping experiments on the cofacially arrayed phthalocyanine polymer $[Si(Pc)O]_n$ using high potential quinone, halogen, or nitrosyl electron acceptors, the achievable degree of partial oxidation, the inhomogeneity of the doping process, and the conductivity mechanism remain remarkably constant. Using wet spinning techniques, it has proven possible to prepare electrically conductive fibers of $[Si(Pc)O]_n$ alone or blended with the high performance aramid polymer Kevlar. (18 refs.)

119559 Synthesis and properties of conducting bridged macrocyclic metal complexes. M.Hanack, A.Datz, W.Kobel, J.Koch, J.Metz, M.Mezger, O.Schneider, H.-J.Schulze (Inst. fur Organische Chem., Univ. of Tubingen, Tubingen, Germany).
J. Phys. Colloq. (France), vol.44, no.C-3, p.633-7 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The synthesis and the properties of polymeric phthalocyaninato-metal complexes with Fe, Ru and Co as the central metal atom are described. $TPPH_2$ and $taaH_2$ are also used as macrocycles. In addition to pyrazine (pyz) and 1,4-diisocyanobenzene (dib) the cyano-group is used as a bridging ligand for the first time, such leading to μ-cyanophthalocyaninatocobalt(III). (7 refs.)

119560 Conducting partially oxidized group IIIA halo-phthalocyanines. D.C.Weber, P.Brant, R.S.Nohr, S.G.Haupt, K.J.Wynne (Naval Res. Lab., Washington, DC, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.639-44 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors report results of doping Group IIIA phthalocyanine fluorides and chlorides with nitrosonium salts of BF_4^- and PF_6^-. Although the chloride system is not polymeric it exhibits properties similar to the polymeric fluoride system. (8 refs.)

119561 DC and microwave conductivity of $FeCl_3$-doped polyparaphenylene $(p\text{-}C_6H_4)_x$. H.Stubb (Semiconductor Lab., Tech. Res. Centre of Finland, Espoo, Finland), H.Isotalo, P.Kuivalainen, J.J.Lindberg, P.Raatikainen, C.Holmstrom.
J. Phys. Colloq. (France), vol.44, no.C-3, p.737-40 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
DC and microwave conductivity and dielectric constant measurements on $FeCl_3$-doped $(C_6H_4)_x$ are reported. It is shown that in lightly doped samples Kivelson's intersoliton hopping conduction model as modified and applied to polaron and bipolaron states fits well. In heavily doped samples variable range hopping seems to dominate and reasonable values for Mott's parameters are found. (11 refs.)

119562 Electrical and magnetic properties of poly p-azophenylene. F.Barbarin, G.Berthet, J.P.Blanc, M.Dugay, C.Fabre, J.P.Germain, H.Robert (LERM, Aubiere, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.749-52 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Conductivity and paramagnetic properties of virgin and doped poly p-azophenylene (PPN) are investigated. AsF_5 doping does not lead to a conductive material while iodine doped PPN reaches a conductivity of 10^{-5} $(\Omega cm)^{-1}$. Strong oxidizing dopants probably induce the break of the $-N=N-$ links. (8 refs.)

119563 The Bechgaard salts: magnetotransport, dimensionality, spin density waves and the threshold field. J.F.Kwak (Sandia Nat. Labs., Albuquerque, NM, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.839-46 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
A review of the metallic-state magnetotransport properties of the superconducting Bechgaard compounds is presented, with emphasis on the unique threshold field associated with the Shubnikov-de Haas effect. Orbit area calculations based on the currently accepted band anisotropy imply nesting of the Fermi surface by an instability at a commensurate wavevector other than the optimal value $(2k_F, \pi/b)$, leading to a model of wavevector commensuration shift at the threshold. The evidence for spin-Peierls ordering as the relevant instability is discussed. Finally, a comment is made regarding the applicability to these materials of any model involving large one-dimensional fluctuations. (28 refs.)

119564 Some properties of $(TMTSF)_2FSO_3$ at low temperature under pressure. D.Mailly, K.Bechgaard, F.Creuzet, T.Takahashi, M.Ribault, D.Jerome (Lab. de Phys. des Solides, Univ. de Paris-Sud, Orsay, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1025-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors have observed a drop of resistivity in $(TMTSF)_2FSO_3$ under pressures higher than 7 kbar at $T=3K$. At $T=0.1K$ the critical magnetic field is 55 kOe along the c* direction, and much higher than 60 kOe along the b* direction. There is no variation of the magnetization associated with the transition. The NMR characteristics are very different from those of other $(TMTSF)_2X$ compounds. (9 refs.)

119565 Low temperature transport measurements on $(TMTSF)_2ClO_4$. Mu-Yong Choi, P.M.Chaikin (Dept. of Phys., Univ. of California, Los Angeles, CA, USA), R.L.Greene.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1067-70 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors have studied the resistance and the thermopower of $(TMTSF)_2ClO_4$ as a function of temperature, magnetic field and quick and slow cooling. Kohler plots of the magnetoresistance indicate that the transport mechanism changes below $\sim$30K. The thermopower is particularly sensitive to a magnetic field along the c* direction at low temperatures, and giant quantum oscillations are observed above a threshold magnetic field below $\sim$2K. They present a model in which there is a large scattering in a small region of the Fermi surface and explain its effect on the transport. (14 refs.)

119566 Solitons in bis-tetramethyltetraselenafulvalene hexafluorophosphate $[(TMTSF)_2PF_6]$. E.M.Conwell (Xerox Webster Res. Center, Webster, NY, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1133-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Since $(TMTSF)_2PF_6$ is commensurate, electrons or holes donated by impurities or other defects should go into soliton states in the gap. The contribution to conductivity of carriers in such states can explain otherwise puzzling low temperature transport properties: (1) Hall constant positive for carriers moving parallel to the chains, while thermoelectric power along the chains is negative, transverse to the chains positive; (2) increase in conductivity at microwave frequencies. (24 refs.)

119567 New organic conductors in TTF family. J.M.Fabre, C.Galaine, L.Giral (Lab. de Chimie Organique Structurale, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1153-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Reports the synthesis, separation and purification of new unsymmetrical tetrathiafulvalenes. The electrochemical preparation of their radical cation salts is described along with preliminary results concerning electrical conductivity and crystallographic data of these salts. (13 refs.)

119568 Quasi-one-dimensional conductors based on tetrathiatetracene (TTT) and tetraselenotetracene (TSeT) with metal complex mercury anions: synthesis, structure, properties. V.F.Kaminskii, E.E.Kostuchenko, R.P.Shibaeva, E.B.Yagubskii, A.V.Zvarykina (Inst. of Chem. Phys., Acad. of Sci., Chernogolovka, USSR).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1167-81 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

A number of TTT and TSeT cation-radical salts with halide-mercuric anions have been obtained. The crystal structures of the salts $TTT_3(Hg_2Br_6)$ and $TTT_3(Hg_2Cl_6)$, $TTT_{1.25}(Hg_2I_5)$, $TSeT_3(Hg_2Br_6)$ and $TSeT_3(Hg_2Cl_6)$, $TSeT_2(Hg_2I_6)$, $TSeT_4(Hg_4I_9)$ have been determined. $TSeT_4(Hg_4I_9)$ is of special interest, since it retains the metallic state down to superlow temperatures. (24 refs.)

119569 Two-dimensionality and anisotropy to the conductivity of a mixed valence nickel bisdithiolato-complex. L.Valade, P.Cassoux, A.Gleizes (Lab. de Chimie de Coordination, CNRS, Toulouse, France), L.Interrante.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1183-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

The highly conducting electrocrystallized mixed valence $[Ni(dmit)_2]$ $(NBu_4)_{0.29}$ complex (dmit=dimercaptoisotrithion) shows an unusual two-dimensional structure as evidenced by X-ray diffraction methods and anisotropic conductivity measurements. (6 refs.)

119570 Liquid crystalline organic conductors. H.Strzelecka, V.Gionis (CNRS, Thiais, France), J.Rivory, S.Flandrois.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1201-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

Introduction of long chain substituents on the phenyls bonded to bi-4-H pyrane and bi-4-H-thiopyrane heterocycles leads to disk-like π-donors. The latter can be transformed into organic conductors with liquid crystalline properties. The synthesis and some physical characteristics of these new materials are given. (10 refs.)

119571 Polypyridinium-TCNQ complex: a new organic conductor. H.Anzai, M.Tokumoto, T.Ishiguro (Electrotech. Lab., Ibaraki, Japan).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1229-34 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

A new organic conductor has been synthesized by the reaction of polypyridinium halides (Cl and Br) with Li-TCNQ in water. The molecular structure was $Py\text{-}(Py^+)_n\text{-}Cl(\text{-}Br).nTCNQ$ where n was 30-100. The room temperature conductivity of compressed samples reached 0.41 S/cm. (4 refs.)

119572 'Organic metals': synthesis of new electron donors derived from bis(chalcogenopyrannylidenes) and 3:3′-bis(1,2-dithiolylidenes). J.Amzil, M.Brutus, G.Le Coustumer, M.Hakiki, J.F.Hemidy, Y.Mollier, J.P.Sauve, M.Stavaux (Univ. de Caen, Caen, France).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1249-52 (June 1983). In French. (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

Charge transfer salts have been obtained from new electron donors: bis(chalcogenopyrannylidenes) and 3:3′-bis(1,2-dithiolylidene) with TCNQ. Electrical and optical properties have been determined on pressed powder at room temperature. (10 refs.)

119573 Phase transition description down to 10K in the first ternary 1D organic conductor: $TMA^+TCNQ^{2/3-}$ $(I_3^-)^{1/3}$. B.Gallois, J.Gaultier (Lab. de Cristallographie, Univ. de Bordeaux I, Talence, France), J.P.Pouget, C.Coulon, A.Filhol.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1307-12 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

X-ray and neutron experiments were performed down to 10K on single crystals of the title compound. Three transitions have been observed respectively at 150K, 95K and 65K. Below $T_t^I=150K$, the occurrence of superstructure reflections characterized by a (0,1/3,0) wave vector allows the description of this first transition as a 'Peierls type' transition, in spite of 3d precursors. it is shown that order degree of the iodine lattice is a relevant parameter of the mechanisms involved in this transition. At 100K, the TCNQ lattice distortion is described looking to recorded structure factors. A change in the iodine pattern at $T_t^{II}=95K$ shows the second transition is a purely structural one. Below 95K, the a* wave vector component shifts and locks at the position 1/6 a* at $T_t^{III}=65K$. (8 refs.)

119574 Diffuse X-ray studies of $TTF_{0.01}TSeF_{0.99}$-TCNQ and DSeDTF-TCNQ. M.Sakai (Dept. of Pure & Appl. Sci., Univ. of Tokyo, Tokyo, Japan), S.Kagoshima, E.M.Engler.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1313-16 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

Behaviors of the $2k_F$ and the $4k_F$ charge-density waves (CDW) in $TTF_{0.1}TSeF_{0.9}$-TCNQ, $TTF_{0.01}TSeF_{0.99}$-TCNQ and DSeDTF-TCNQ observed by X-ray scattering are reported. Discussions are made of origins of the $4k_F$ CDW and the interchain interactions among the $2k_F$ CDW. (16 refs.)

119575 High pressure effects in MEM-$(TCNQ)_2$. D.Bloch (Lab. Louis Neel, CNRS, Grenoble, France), J.Voiron, C.Vettier, J.W.Bray, S.Oostra.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1317-20 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

MEM-$(TCNQ)_2$ possesses at room pressure both an electronic transition, associated with a $4k_F$ lattice distortion and a magnetic-to-nonmagnetic transition associated with a $2k_F$ lattice distortion. They disappear above 4 kbar. (10 refs.)

119576 $[H_3NCH_2CH_2NH_3]_{0.82}[Pt(C_2O_4)_2].2H_2O$—a new partially oxidised bis(oxalato)platinate. A.E.Underhill, M.Mizuno (Univ. Coll. of North Wales, Bangor, Wales), K.Krogmann, M.Rosch.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1331-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

The preparation of the new I-D conductor $[H_3NCH_2CH_2NH_3]_{0.82}[Pt(C_2O_4)_2].2H_2O$ (en-OP) is described together with the results of structural and electrical conductivity studies. (9 refs.)

119577 The low temperature P-T phase diagram of TTF-TCNQ. C.Hartzstein, V.Zevin, M.Weger (Racah Inst. of Phys., Hebrew Univ. of Jerusalem, Jerusalem, Israel).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1335-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

A microscopical mechanism for indirect interaction between similar chains '2a' apart is proposed in order to account for the '4a' commensurate phase at low temperatures. CDW-CDW $2k_F$-$4k_F$ intrachain and $4k_F$-$4k_F$ interchain interactions are included in the free energy and the relevant interaction parameters are estimated. They are large enough to account for the pinning of the '4a' transverse period at low temperatures. The theoretical phase diagram is obtained from the numerical minimization of the free energy and it fairly reproduces the low temperature phases of TTF-TCNQ. (11 refs.)

119578 $4k_F$ and $2k_F$ transitions in the organic conductor: DBTTF-$TCNQCl_2$. K.Mortensen, C.S.Jacobsen, A.Lindegaard-Andersen (Lab. of Appl. Phys., Tech. Univ. of Denmark, Lyngby, Denmark), K.Bechgaard.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1349-52 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

Presents experimental studies of the organic conductor DBTTF-$TCNQCl_2$, which exhibits separated electronic-Peierls ($4k_F$) and spin-Peierls ($2k_F$) transitions. The studies include X-ray diffuse scattering, transport and magnetic measurements. (6 refs.)

119579 Conducting cation-radical salts based on DBTTF and its selenium analogue, DBTSF. I.Johannsen, K.Mortensen, C.S.Jacobsen, N.Thorup, G.Rindorf (Tech. Univ. of Denmark, Lyngby, Denmark), K.Bechgaard.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1361-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

Presents structural, magnetic and transport properties of a series of new cation-radical salts with the general formulas $DBTTF(X)_t$ and $DBTSF(Y)_u$. X may be PF_6 or ClO_4 and Y may be TaF_6, SbF_6 or AsF_6. (3 refs.)

119580 Physical properties of a new highly conducting TCNQ salt: $MPht(TCNQ)_2$. A.Graja, M.Przybylski, G.Sekretarczyk (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland), W.Pukacki, A.Rajchel, M.R.Willis, S.C.Wallwork, G.Mihaly, L.Mihaly.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1365-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

The highly conducting $MPht(TCNQ)_2$ salt has been synthesized and characterized. The conductivity is described in terms of 'metal-like' semiconductor with a large, strongly temperature-dependent mobility. The magnetic susceptibility is thermally activated; spins and charge carriers are activated with the same energy. The temperature-dependence of the optical phonons (a_g modes) is studied. (no refs.)

119581 Electrical properties of an irradiated methyl-pyridinium-TCNQ salt. M.Przybtylski, W.Pukacki (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland), L.Zuppiroli.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1369-72 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

Fast electrons have been used to irradiate and disorder the organic-semiconductor $NMe3.5MePy(TCNQ)_2$. At low irradiation doses ($\Phi<20$ mC/cm^2) the radiation induced defects are shown to dope the semiconducting samples and increase their room temperature conductivity up to a factor of ten. At higher doses, a localization process dominates conductivity and thermopower. (8 refs.)

119582 Electric conductivity and thermopower of quasi one-dimensional $(perylene)_2(AsF_6)_{0.75}(PF_6)_{0.35}.0.85CH_2Cl_2$ crystals. K.Bender, D.Schweitzer, H.J.Keller (Max Planck-Inst., Heidelberg, Germany).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1433-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

The temperature dependence of the conductivity parallel and perpendicular to the stack axis as well as of the thermopower S of $(pe)_2(AsF_6)_{0.75}(PF_6)_{0.35}.0.85CH_2Cl_2$ crystals is reported. (9 refs.)

119583 Long range phase coherence in the current-carrying charge density wave state. G.Gruner, A.Zettl (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1631-7 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

Various experiments involving the joint application of AC and DC driving fields, $V=V_{dc}+VP_{ac}\cos\omega t$, are reported in the linear chain compound $NbSe_3$ (1) the direct observation of current oscillations with the relation between frequency f_0 and CDW current I_{CDW} given by $I_{CDW}/f_0=2en(T)/n(0)$ where n(T) is the number of condensed electrons; (2) the AC field induced steps in the I-V curve[3]; and (3) changes in the AC response when $\omega/2\pi=f_0$. The analysis of these experiments leads to coherent CDW responses, which involve the total volume of the specimens, strongly suggesting long range phase coherence in the current carrying state. While the single coordinate descriptions account for these observations, they do not explain the broad band noise and the finite width of the narrow band peaks. A short comparison with recent theoretical attempts to explain these observations will be given. (18 refs.)

119584 Temperature dependence of the upper threshold field E_{T1} in $NbSe_3$. K.Tsutsumi, T.Tamegai (Dept. of Pure & Appl. Sci., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1677-80 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors measured the temperature dependence of the upper threshold field E_{T1} in $NbSe_3$ single crystals with the various residual resistivity ratios. The temperature dependence of E_{T1} is discussed by Fukuyama-Lee weakly impurity pinning model. (9 refs.)

119585 Charge density wave fluctuations in $TaSe_3$ and $NbSe_3$. J.Richard, H.Salva, M.C.Saint Lager, P.Monceau (Centre de Recherches sur Les Tres Basses Temperatures, CNRS, Grenoble, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1685-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors report a study of the influence of charge density wave fluctuations on transport properties of TaS_3 (with the orthorhombic unit cell) and of $NbSe_3$. (7 refs.)

119586 Microwave harmonic mixing in $NbSe_3$. W.Mayr, A.Philipp, K.Seeger (L. Boltzmann Inst. fur Festkorperphys., Wien, Austria).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1693-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
By mixing a microwave and its second harmonic at the nonlinear current voltage characteristic of niobium triselenide a small DC signal is generated between the ends of the filamentary sample. The temperature dependence is in qualitative agreement with theoretical calculations based on Bardeen's theory of tunneling of charge density waves although some details of both the experimental results and the theory are not yet fully understood. (5 refs.)

119587 Influence of Mo- and Co-impurities on the non-Ohmic DC-conductivity in $NbSe_3$. H.Gruber, H.Sassik (Inst. fur Festkorperphys., Tech. Univ. Graz, Graz, Austria).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1717-20 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The effect of Co and Mo-impurities on the non-Ohmic DC-conductivity between 4.2K and 300K has been studied. The suppression of the anomalous behaviour of the resistivity for Co- and Mo-impurities is differently strong. (6 refs.)

119588 AC conductivity of near-commensurate charge density waves—application to $NbSe_3$ and TaS_3. B.Horovitz, S.E.Trullinger (Dept. of Nuclear Phys., Weizmann Inst. of Sci., Rehovot, Israel).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1721-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The AC conductivity of a charge density wave with a low phase kink density is evaluated. The results explain the broad crossover regime of $NbSe_3$ as compared with the similar but more commensurate TaS_3. When TaS_3 becomes commensurate ($T \lesssim 130K$) its critical field should decrease (in agreement with experiment) and its AC response should increase and slightly sharpen. (11 refs.)

119589 Strong electron-phonon interaction in quasi-one-dimensional conductor $M_xV_2O_5$ systems. H.Nagasawa, T.Erata, M.Onoda, H.Suzuki (Inst. of Phys., Univ. of Tsukuba, Tsukuba, Japan), Y.Kanai, S.Kagoshima.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1737-40 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
In quasi-one-dimensional conductor β-$M_xV_2O_5$, the CDW states were observed below about 200K by X-ray diffraction. The V Knight shift results show the spin-singlet ground state of V(4+) ion pair (BIPOLARON) is realized. On the basis of magnetic relaxation measurements, the high conductivity parallel to the chain axis in β-$Na_{.40}V_2O_5$ is interpreted as the collective motion of BIPOLARONS. (11 refs.)

119590 Solitons with adjustable charge in a commensurate Peierls insulator. S.Kivelson (Dept. of Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2653-8 (1 Sept. 1983).
The author considers a one-dimensional electron gas with a half-filled band in which the electrons are coupled to both intersite and intrasite lattice distortion. In the region of parameter space in which both types of distortion develop nonzero expectation values, a new class of soliton which spontaneously breaks the charge conjugation symmetry of the model appears as the lowest-lying electronic excitation of the system. The soliton charge is a continuous function of the coupling constants. (11 refs.)

119591 Spatial dispersion effects in the conductivity of one-dimensional metals. L.V.Chebotarev, E.A.Kaner (Inst. of Radiophys. & Electronics, Acad. of Sci., Kharkov, Ukrainian SSR).
Solid State Commun. (USA), vol.48, no.4, p.333-6 (Oct. 1983).
The dependence of the conductivity of a 1D conductor on the wavevector q is calculated and analysed taking into account both the localization phenomenon and the fluctuations of the electronic collision frequency. In the high frequency region the conductivity is given by the Drude formula (allowing for the spatial dispersion), being averaged over the fluctuations of the collision frequency. In the low frequency limit, owing to the predominant effect of localization, the frequency dependence type with finite q differs significantly from that with $q=0$. The dissipative conductivity decreases with growing q and has a power law dependence with the exponent depending on q. (4 refs.)

119592 On the nonlinear field-effect of orthorhombic TaS_3. Zhang Dian-lin (Inst. of Phys., Chinese Acad. of Sci., Beijing, China).
Solid State Commun. (USA), vol.48, no.4, p.369-71 (Oct. 1983).
The true DC measurement of electrical field effect on the resistivity of orthorhombic TaS_3 in the CDW state was performed for the first time with extremely short distances between the contacting leads. Very weak nonlinear effect was observed up to 1300 V cm^{-1}. A distinct resistivity-increasing effect was found, which cannot be understood within the framework of any currently available theories. The author proposes a transverse tunneling model to account for this anomaly. (10 refs.)

Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors) .... See Entry 116922

Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals) .... See Entry 116923

Chemical n-doping of polyacetylene .... See Entry 118904

Structure and properties of conducting polyacetylene complexes .... See Entry 118907

Synthesis and properties of $(CH)_x$-films prepared by polymerization of BTFM-TCDT .... See Entry 118911

Chemistry and characterization of group V transition metal trichalcogenides .... See Entry 118982

A new family of compounds exhibiting the $FeNb_3Se_{10}$ structural type: structural and resistivity measurements .... See Entry 118983

New one-dimensional Vb transition metal tetrachalcogenides structural and transport properties .... See Entry 118984

Influence of the disorder potential of the anions on the ground state of the organic alloy $(TMTSF)_2(ClO_4)_{1-x}(ReO_4)_x$ .... See Entry 118994

Radical cation salts of arenes, synthesis, structures and properties .... See Entry 118995

Doping kinetics of polyacetylene in the short range .... See Entry 119042

Iron (III) perchlorate doping of polyacetylene .... See Entry 119043

Stability of polyacetylene doped by ion implantation .... See Entry 119044

Peierls instability and vibrational spectra of polyacetylene .... See Entry 119142

Landau theory of pressure induced phase transitions in TTF-TCNQ .... See Entry 119178

Solitons in nearly commensurate organic charge transfer crystals .... See Entry 119390

Shubnikov-de Haas oscillations in TMTSF-DMTCNQ .... See Entry 119402

Fermi-surface nesting, closed orbits, and the 'threshold field' in an organic superconductor .... See Entry 119405

Effects of off-diagonal disorder on soliton- and polaron-like states in trans-polyacetylene .... See Entry 119415

Structural energy and stability condition of the Peierls state .... See Entry 119437

Suppression of the Peierls transition by chemical modification .... See Entry 119439

Charge density wave dynamics in the incommensurate and commensurate TaS_3 .... See Entry 119446

Switching and hysteresis in $NbSe_3$ .... See Entry 119450

Characterization of the CDW transition in orthorhombic TaS_3 by thermoelectric power and magnetic susceptibility measurements .... See Entry 119451

Effect of disorder on the charge density wave transitions and transport in orthorhombic TaS_3 .... See Entry 119452

Peierls transition in the quasi-one dimensional blue bronzes $K_{0.30}MoO_3$ and $RbO_{0.30}MoO_3$ .... See Entry 119453

Two CDW's locking model in orthorhombic TaS_3 .... See Entry 119454

Peierls and spin-Peierls phase transitions in systems with coupled softening modes .... See Entry 119457

Polarons in quasi-one-dimensional conducting polymers .... See Entry 119475

Charge ordering in 1-D molecular type crystals .... See Entry 119482

Theoretical studies of the physics of charged defect formation in doped organic polymers: towards a coherent theoretical picture .... See Entry 119513

Calculation of the charge transfer in ion-radical salts .... See Entry 119519

Electrical transport properties of iodine doped polyacetylene .... See Entry 119603

Electrically conductive polymer-polymer composites .... See Entry 119604

Photogeneration of solitons in trans-$(CH)_x$: the reversed spin-charge relation of the photoexcitations .... See Entry 119654

Photoproduction of neutral versus charged solitons in trans $(CH)_x$ .... See Entry 119655

Photogeneration and geminate recombination of charge carriers in a quasi-one-dimensional system .... See Entry 119656

Semiconductor to metal transition in $MoCl_5$ doped polyacetylene .... See Entry 119671

Noise in highly correlated commensurate charge transfer salts .... See Entry 119675

Nonlinear AC dynamics and conduction noise in $NbSe_3$ .... See Entry 119676

Theory of the narrow band noise spectrum and metastable conductivity due to sliding charge density waves .... See Entry 119677

Transport properties under pressure of the organic conductors $(TMTTF)_2X$; $X=PF_6$, ClO_4, Br .... See Entry 119742

Conduction properties of $ZrTe_3$ .... See Entry 119746

Superconductivity and anomalous magnetotransport in $(TMTSF)_2ClO_4$ .... See Entry 119768

Magnetic susceptibility of the one-dimensional metal $Li_xPt(C_2S_2(CN)_2)_2$, $2H_2O$ .... See Entry 119812

Magnetic properties of some morpholinium $(TCNQ)_2$ salts .... See Entry 119825

Spin dynamics and soliton motion in trans-$(CH)_x$ .... See Entry 119893

Electron spin motion in trans-$(CH)_x$ .... See Entry 119895

ESR and conductivity studies of doped polyacetylene .... See Entry 119896

Magnetic resonance studies on iodine doping of polyacetylene .... See Entry 119912

Electron spin echo determination of spin diffusion in the one-dimensional conductor $(fluoranthenyl)_2^+(PF_6)_x^-(SbF_6)_{1-x}^-(x \approx 0.5)$ .... See Entry 119913

Doping and degradation of polyacetylene by nitric acid .... See Entry 120054

Poly(para phenylene): Some properties related to the synthesis method .... See Entry 120065

Far-infrared properties of $(TMTSF)_2ClO_4$ at low temperatures .... See Entry 120068

Peierls instability of the organic linear chain semiconductor TEA $(TCNQ)_2$ [Raman study] .... See Entry 120070

Infrared studies of phase transitions in single- and two-chain organic charge transfer conductors .... See Entry 120071

Spectral studies of the phase transitions in $MTPP(TCNQ)_2$ and $MEM(TCNQ)_2$ .... See Entry 120072

Plasma reflectance of the one-dimensional organic metals of the type $(arene)_2XF_6$(arene = perylene, pyrene or fluoranthene; X = P, As, Sb) .... See Entry 120073

Far-infrared properties of trimethylammonium idodide tetracyanoquinodimethane .... See Entry 120074

The low-temperature optical properties of TTF-TCNQ in the far-infrared .... See Entry 120075

Effects of solvents and cell design for crystal growth of organic metals .... See Entry 120233

Electrocrystallization of the complexes of tetrathiatetracene and synthesis of tetraselenaanthracene .... See Entry 120234

Intercalation of tetrathiafulvalene, tetrathiatetracene, and related molecules into iron oxychloride .... See Entry 120270

Formation of highly conducting derivatives of polyacetylene through oxidation with selected metal halides .... See Entry 120298

Conducting SN polymers with integrated organic groups .... See Entry 120300

Stability of iodine-doped polyacetylene in aqueous environments .... See Entry 120612

New synthetic approaches to tetrathiafulvalene derivatives: systematic modifications of BEDT-TTF and TMTTF donors .... See Entry 120615

BDMT-TXF—a new series of tetrachalcogen fulvalenes .... See Entry 120616

Polymerization of acetylene with new catalysts, new doping agents, morphology and electrical conductivity of the doped polyacetylene films .. See Entry 120627

The aqueous and non-aqueous electrochemistry of polyacetylene: application in high power density rechargeable batteries .... See Entry 120643

Electrochemical solid-state study of organic conducting materials .... See Entry 120646

72.15Q Scattering mechanisms and Kondo effect

(see also 75.20H Local moments in dilute alloys)

Magnetic properties of $Cr_{1-x}Fe_xGe$ .... See Entry 119822

72.20 CONDUCTIVITY PHENOMENA IN SEMICONDUCTORS AND INSULATORS

(for nonelectronic thermal conduction, see 66.70)

Electrical, optical and glass transformation properties of amorphous solids—a review .... See Entry 119543

72.20D General theory, scattering mechanisms

119593 Linear conductance of very short semiconductor samples. S.Eranen, J.Sinkkonen, T.Stubb.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.45-9 (1983).
Using the Landauer formula, the authors describe the length-dependent linear conductance in intrinsic semiconductor samples, which are much shorter than thermal scattering mean free paths and are sandwiched between two metallic plates. The semiconducting region has been modeled as a variable length Kronig-Penney chain, the transmission coefficient of which can easily be obtained using the ordinary transfer matrix method. Even for a sample thickness of one atomic layer only, the transmission coefficient reveals some features of the band structure of the infinite chain, which then becomes more and more evident with increasing sample length. In short samples, the current flows by tunneling through regions near the contact Fermi level, resulting in strongly length-dependent conductance. For long samples with a sufficiently deep transmission gap at forbidden energies, the conductance finally saturates near the thermionic emission value. (16 refs.)

119594 Dynamic dielectric response to carrier-carrier interactions in narrow-gap semiconductors. J.R.Meyer, F.J.Bartoli (Naval Res. Lab., Washington, DC, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1752-5 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
For the first time, the dynamic dielectric response of the screening medium within a narrow-gap semiconductor is properly taken into account in treating electron-hole scattering. The interaction potential is shown to have the strikingly simple form $U(\mathbf{q},\omega)=V(\mathbf{q})/\epsilon(q,\omega=\mathbf{q}.\mathbf{v}_h)$, where $V(\mathbf{q})$ is the bare Coulomb potential, $\mathbf{v}_h$ is the hole velocity, and $\epsilon(q,\omega)$ is the dielectric constant of the medium. The screening medium is assumed to consist of core electrons, lattice ions, free electrons, and free holes. The effects of dynamically treating the slowly responding lattice ions and free holes are discussed in detail. It is shown that previous approximations of employing the static and high frequency limits lead to significant error in the calculated electron-hole scattering mobility. (9 refs.)

119595 The scattering of charge carriers in large electron-hole drops in germanium. S.V.Bogdanov, Ya.E.Pokrovskii (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. Phys.-JETP (USA), vol.56, no.6, p.1350-3 (Dec. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.6, p.2329-34 (Dec. 1982). [received: Oct. 1983]
The temperature dependence of energy absorption from an alternating magnetic field on photoexcitation of germanium, due to excitation of eddy currents in the conducting medium, has been studied. The mobility of free electrons and holes and the mobility in large electron-hole drops are determined from the dependence of this absorption on the strength of the DC magnetic field. It is shown that between 2 and 4.2K the mobility of both free and condensed charge carriers is determined by scattering by acoustic phonons. (9 refs.)

119596 The influence of spin-electron interaction on characteristics of current carriers in ferrimagnetic semiconductors. A.A.Trushchenko.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1388-93 (Sept. 1983). In Russian.
A weak exchange *s-d* or *s-f* interaction of conduction electrons with spins of magnetic atoms is considered in ferrimagnetic semiconductors with two collinear magnetic sublattices. The conduction electron energy shift is determined in a spin-wave approximation by the method of Green's temperature functions. It is true when spin-moments of the sublattice ions are equal but their *g*-factors are different, which results in unequal magnetic moments of sublattices. (7 refs.)

Unified theory of AC and DC hopping conductivity in disordered systems .... See Entry 119535

Mobility of carriers in inversion layers in semiconductors ..... See Entry 119619

72.20F Low-field transport and mobility; piezoresistance

119597 Specific electrical resistivity of TiC-C system alloys in the temperature range 300-2000K. S.G.Gorinskii, O.V.Fedorenko, A.R.Beketov, A.F.Kokorin (S.M. Kirov Polytech. Inst., Urals, USSR).
Inorg. Mater. (USA), vol.18, no.10, p.1475-8 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1717-20 (Oct. 1982). [received: Sept. 1983]
The specific electrical resistivity was investigated in the temperature interval 300-2000K for TiC-C system alloys obtained by arc melting. A model for the electron transport is suggested. Using known values for the specific electrical resistivity of titanium carbide and quasi-monocrystalline graphite the specific electrical resistivity of the alloys studied has been studied and results are in satisfactory agreement with the experimental data. (7 refs.)

119598 Experimental study of the electrical conductivity of the monocrystalline trioxide of molybdenum, MoO_3. A.Steinbrunn, H.Reteno, C.Lattaud (Lab. de Recherches sur la Reactivite des Solides, Faculte des Sci. Mirande, Dijon, France).
J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.6, p.523-8 (June 1983). In French.
Pure single crystals of MoO_3, for electrical conductivity measurements, were carefully grown by physical vapor transport. DC conductivity measurements were performed in the 100-400°C temperature range and for partial oxygen pressures between 350 Torr and the dissociation pressure of the oxide. The conductivity value is found to increase with departure from stoichiometry, while the activation energy decreases (0.76 to 0.07 eV). A twinned layer model is proposed in terms of an interaction of the solid with the gas phase: an electronic hopping conduction between Mo^{5+} sites enables one to interpret the results obtained. (18 refs.)

119599 Electrical resistivity of ferrites of the general formula $Mg_{1+t}Fe_{2-2t}Ti_tO_4$(t=0.1, 0.3, 0.4, 0.5). M.A.Semary, M.A.Ahmed (Phys. Dept., Cairo Univ., Giza, Egypt), Y.Abbas.
J. Mater. Sci. (GB), vol.18, no.10, p.2890-2 (Oct. 1983).
The electrical resistivity of the ferrites $Mg_{1+t}Fe_{2-2t}Ti_tO_4$ (t=0.1, 0.2, 0.3, 0.4, 0.5) has been measured in the temperature range of 30 to 300°C. A break in In ρ against $1/T$ around T_c has been observed. This break is associated with a change in the activation energy around the Curie temperature. The conductivity behaviour is discussed in terms of the cation distribution in these ferrites. (9 refs.)

119600 Electronic and electrogalvanic properties of α silver telluride. G.Bonnecaze, A.Lichanot (Inst. Univ. de Recherche Sci., Pau, France), S.Gromb.
J. Phys. & Chem. Solids (GB), vol.44, no.10, p.967-74 (1983). In French.
A study of the electronic and electrogalvanic properties of α silver telluride has been performed on samples whose non-stoichiometry has been determined by coulometric titration with the cell $Ag/AgI/Ag_2Te/Pt$. The data lead to the adoption of a model of Frenkel defects on the silver sublattice that are fully ionised. The homogeneity range is reported from 162 to 508°C: it extends essentially on the tellurium side of the stoichiometric composition. The free energies of formation of the α and β forms of the tellurides whose compositions are near $Ag_{1.6}Te$, $Ag_{1.9}Te$ and $Ag_{2.0}Te$ have been determined between 23°C and 360°C. (25 refs.)

119601 Electrical conduction mechanism in crystal violet dye sensitised with AgI. G.D.Sharma, A.K.Tripathi, D.C.Dube, S.C.Mathur (Dept. of Phys., Indian Inst. of Technol., New Delhi, India).
J. Phys. D (GB), vol.16, no.10, p.1977-83 (14 Oct. 1983).
The theory of dark conduction in dyes assumes thermal excitation from the ground state to an excited state, followed by trapping of the hole near the electrode. Electrical conductivity studies on crystal violet (CV), an organic dye of industrial importance, have been carried out in both dark and light conditions. The present paper deals with the effect of field, temperature and electrode materials on the electrical conduction in CV as well as in CV sensitised with AgI. These studies suggest that conduction is mainly due to the charge carriers injected from the electrode into the dye (Schottky-Richardson mechanism) and the electron transfer mechanism. Photo and dark activation energies in the sensitised dye have been calculated. (8 refs.)

119602 Semiconduction in silver orthoarsenate. K.Tennakone (Dept. of Phys., Ruhuna Univ. Coll., Matara, Sri Lanka).
J. Solid State Chem. (USA), vol.49, no.2, p.256-7 (Sept. 1983).
Silver orthoarsenate is found to be an n-type semiconductor of electron activation energy 0.61 eV. Silver orthoarsenate (Ag_3AsO_4) is prepared as a brick red powder consisting of cubic crystals. To measure the resistivity the powder was compacted into a glass tube (diameter 0.8 cm) and pressed between carbon electrodes to a pressure $\sim 10^5$ Pa, so that a pellet of length ~ 0.5 cm is formed. At this pressure the effect of grain boundaries becomes negligible and the conductivity characteristics are found to be independent of the polarity. (4 refs.)

119603 Electrical transport properties of iodine doped polyacetylene. K.Ehinger, W.Bauhofer, K.Menke, S.Roth (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
J. Phys. Colloq. (France), vol.44, no.C-3, p.115-18 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Measurements of the DC conductivity and the 10 GHz microwave conductivity of iodine doped cis and trans polyacetylene in the temperature range from 4.2K to 300K are reported. At room temperature no sample shows a frequency dependence; at low temperatures, however, the microwave conductivity of moderately doped samples is considerably higher than the DC value. From the magnetoresistance at liquid helium temperature, an 'effective' Hall mobility in the order of magnitude of $10^2 cm^2/Vsec$ is estimated for samples with various iodine concentrations. (15 refs.)

119604 Electrically conductive polymer-polymer composites. M.E.Galvin, G.E.Wnek (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.151-3 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Conductive composites have been prepared by polymerization of acetylene in polyethylene films followed by iodine doping. The attainment of high conductivity (5-10 S/cm) at low $(CH)_x$ concentrations (~3 wt.%) is explained with a simple percolation model. (4 refs.)

119605 Polaron-soliton model for macroscopic conduction in doped polyacetylene. A.G.MacDiarmid, T.-C.Chung (Dept. of Chem., Univ. of Pennsylvania, Philadelphia, PA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.513-16 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The model proposed applies to p- or n-doped $(CH)_x$ in the 'intermediate' doping regime between ca. 0.2% and ca. 7% doping. Since solitons or soliton bands in this regime are either completely empty (p-doping) or completely filled (n-doping), it has been difficult to envisage how either high intra- or inter-chain conductivity can occur. The authors have recently obtained experimental evidence indicating a significant population of positive and negative polarons in p- and n-doped $(CH)_x$, respectively, up to ca. 5% doping levels. This is understandable since an even number of charge in a conjugation sequence gives an even number of solitons whereas an odd number of charges results in one polaron and an even number of solitons. (no refs.)

119606 AC hopping conduction in undoped trans-polyacetylene. J.A.Chroboczek (Max Planck Inst., Grenoble, France), S.Summerfield.
J. Phys. Colloq. (France), vol.44, no.C-3, p.517-20 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors show that within the extended pair approximation (EPA) the transition rate of Miller and Abrahams (1960) accounts better for the behaviour of $\sigma(\tau,\omega)$, and of $\sigma_{DC}(T)$ than that given by Kivelson (1982). (10 refs.)

119607 Electronic and ionic transport properties of electrodeposited polypyrrole films. P.Mirebeau (Lab. de Recherches, Compagnie Europeenne d'Accumulateurs, Clichy, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.579-82 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Polypyrrole films have been electrodeposited on stainless steel electrodes. The author defines the limits (current density, temperature) in which a conductive film can be obtained. The ratio of the electronic conductivity perpendicular to the film surface over the electronic conductivity parallel to the film surface is smaller than 10^3. The dependence of the perchlorate ions diffusion coefficient versus temperature corresponds to an activation energy of 30 kJ/mole. (5 refs.)

119608 Investigation on the physical properties of polypyrrole. F.Devreux, F.Genoud, M.Nechtschein, J.P.Travers, G.Bidan (Dept. de Recherche Fondamentale, CENG, Grenoble, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.621-4 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors report transport properties and magnetic resonance measurements carried out on polypyrrole samples. (3 refs.)

119609 Electric conductivity of polyacenic system—toward one-dimensional graphite. T.Yamabe (Dept. of Hydrocarbon Chem., Kyoto Univ., Kyoto, Japan), K.Tanaka, K.Ohzeki, S.Yata.
J. Phys. Colloq. (France), vol.44, no.C-3, p.645-50 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
A new material, which is supposed to have a mixed structure of the polyacenic skeletons, has been synthesized. It shows a wide range of electric conductivity according to the preparing process of the carbonization and/or doping. (4 refs.)

119610 Electrically conducting aromatic polymers:poly(phenylene vinylene) and its analogs. J.R.Reynolds (Polymer Sci. & Engng. Dept., Univ. of Massachusetts, Amherst, MA, USA), F.E.Karasz, J.C.W.Chien, K.D.Gourley, C.P.Lillya.
J. Phys. Colloq. (France), vol.44, no.C-3, p.693-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
A variety of arylene vinylene compounds including poly(phenylene vinylene) (PPV) and its analogs have been prepared and doped with arsenic pentafluoride to form electrically conducting materials. (5 refs.)

119611 Some new conducting complexes of nickel. G.C.Papavassiliou (Theoretical & Phys. Chem. Inst., Nat. Hellenic Res. Found., Athens, Greece).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1257-60 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The cation-deficient nickel dithiolenes $Z_xNi(C_3S_5)_2$,Z_x $Ni(R_2C_2S_2)_2$ and the mixed valence compounds $Ni(dapn)_2X\ Y_2$ (where: Z=cation; R=CN, SCH_3, etc.; $x \ll 1$; X=Cl, Br; Y=Cl, Br, $C10_4$; dapn=1,2-diaminopropane) have been prepared and studied. (13 refs.)

119612 Pressure effects in $HfTe_5$ and $ZrTe_5$. W.W.Fuller, S.A.Wolf, T.J.Wieting (Naval Res. Lab., Washington, DC, USA), R.C.LaCoe, P.M.Chaikin, C.Y.Huang.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1709-12 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors have measured the effect of pressure (0-17 kbar) on the resistivity and the thermopower of $HfTe_5$ and $ZrTe_5$ as a function of temperature. Pressure affects these two materials in different ways. The resistance shows a greater effect than the thermopower. There is a larger effect in $HfTe_5$ than in $ZrTe_5$. Possible explanations in terms of a Fermi surface instability and a semi-metal are given. (8 refs.)

119613 Amorphous silicon-phosphorus layer. A.V.Dvurechenskii, I.A.Ryazantsev, L.S.Smirnov (Inst. of Semiconductor Phys., Acad. of Sci., Novosibirsk, USSR), H.Klose, M.Rieth.
Phys. Status Solidi a (Germany), vol.79, no.1, p.83-6 (Sept. 1983).
EPR, photo- and dark conductivity are investigated for amorphous silicon films prepared by vacuum deposition of the silicon-phosphorus vapour mixture. It is shown that as the phosphorus vapour pressure increases ($p_p \geq 10^{-3}$ Pa) the conductivity decreases the paramagnetic centres with $g=2.0055$ disappear. The temperature dependence of the dark conductivity and EPR data permit the conclusion that the phosphorus doping by vacuum evaporation technique enables one to decrease the localized state density in a-Si down to 10^{17} cm^{-3} eV^{-1}. With a further increase of p_p ($>10^{-3}$ Pa) the n-type conductivity appears. The maximum value of σ is 10^{-3} $(\Omega\ cm)^{-1}$, though the phosphorus concentration in a-Si:P ranges from 10^{19} to 3×10^{22} cm^{-3}. It is found that the a-Si:P layers are characterized by high values of photoconductivity and are thermally stable when heated up to 500°C. (11 refs.)

119614 Electrical studies on $(Mo/W)Se_2$ single crystals. III. Anisotropy in resistivity. M.K.Agarwal, P.D.Patel, O.Vijayan (Dept. of Phys., Sadar Patel Univ., Vallabh Vidyanagar, India).
Phys. Status Solidi a (Germany), vol.79, no.1, p.103-8 (Sept. 1983).
For pt.II see ibid., vol.78, p.469 (1983). The anisotropy in resistivity along and across the layers of the layered single crystals in the series $Mo_xW_{1-x}Se_2$ $(0 \leq x \leq 1)$ are studied in the temperature range from 300 to about 600K. The crystals are grown by a direct vapour transport technique. The anisotropy parameters of these crystals have values $\leq 10^6$. The band mass anisotropy (m_a/m_c) is found to be ≈ 10 near the WSe_2-end and $\approx 10^4$ near the $MoSe_2$-end of the system. (23 refs.)

119615 Cation mixing and the AC conductivity of $CdInGaS_4$. A.N.Anagnostopoulos, A.Karoutis (First Lab. of Phys., Aristoteles Univ. of Thessaloniki, Thessaloniki, Greece).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K29-33 (Sept. 1983).
The authors show that the exchange of 1/3 Ga and 1/3 Cd cations explains the frequency-dependent AC conductivity of $CdInGaS_4$, measured parallel to the c-axis of this compound. (11 refs.)

119616 Influence of growth dislocations on low temperature conductivity in irradiated p-germanium. V.P.Dobrego, A.K.Fedotov (Belorussian State Univ., Minsk, Belorussian SSR).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K45-8 (Sept. 1983).
The correlation between the low temperature conductivity of irradiated samples and the concentration and distribution of growth dislocations is examined. The authors have studied germanium single crystals, gold doped, $N_{Au}=(0.7$ to $1.0)\times10^{15}$ cm^{-3} and weakly compensated by antimony. The growth dislocation density was $D=10^3$ to 10^4 cm^{-2}. The samples studied were irradiated by γ-quanta of ^{60}Co with a fluence of 8×10^{15} cm^{-2}. (10 refs.)

119617 On the hole mobility of $CuGaSe_2$. S.M.Wasim, G.Sanchez Porras (Dept. de Fisica, Facultad de Ciencias, Univ. de Los Andes, Merida, Venezuela).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K65-8 (Sept. 1983).
The authors analyze the mobility data, already published, to account for the different scattering mechanisms of the charge carriers in $CuGaSe_2$ which also gives an estimate of certain band parameters. It is observed that in the bulk sample at lower temperatures the charge carriers are predominantly scattered by ionized impurities, whereas both in the thin film and at higher temperatures in the bulk samples, the main scattering mechanisms are due to acoustic and optical modes. (15 refs.)

119618 Electrical properties of vapour phase grown $(ZnSe)_x(CdTe)_{1-x}$ single crystals. P.Chandrasekharam, D.R.Reddy, B.K.Reddy (Dept. of Phys., Sri Venkateswara Univ., Tirupati, India).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K103-7 (Sept. 1983).
The electrical properties of $(ZnSe)_x(CdTe)_{1-x}$ are reported for the first time. The conductivity and Hall effect studies were carried out simultaneously on the same samples using the DC van der Pauw technique. However, for as-grown crystals the two-probe method was used. The type of conductivity was determined by the sign of Hall voltage/hot probe test. (8 refs.)

119619 Mobility of carriers in inversion layers in semiconductors. M.V.Krylov, R.A.Suris.
Sov. Phys.-JETP (USA), vol.56, no.6, p.1316-20 (Dec. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.6, p.2273-80 (Dec. 1982). [received: Oct. 1983]
A theoretical investigation is made of the influence of the surface roughness on the carrier mobility in inversion layers in semiconductors. A relationship is obtained between this mobility and the main parameters of the roughness: the average height of the projections and the characteristic scale in the tangential direction. The dependence of the mobility on an electric field normal to the surface is found. The temperature dependence of the mobility is studied: in contrast to the well-known Schrieffer theory, the dependence agrees well with the available experimental results. (12 refs.)

Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride .... See Entry 116917

Synthesis and properties of $(CH)_x$-films prepared by polymerization of BTFM-TCDT .... See Entry 118911

A new form of polyacetylene .... See Entry 118912

Characterization of polypyrrole .... See Entry 118914

New calcium gallates of lanthanum and neodymium .... See Entry 118964

Radical-cation salts of substituted perylenes .... See Entry 118997

Electrical and structural characterisation of $(DBzBP)(TCNQ)_4$ .... See Entry 119002

The effect of annealing on the defect structure and electrical properties of deformed single crystals of Ge .... See Entry 119019

Doping of $(CH)_x$ films with lanthanides salts .... See Entry 119045

Strengthening of GaAs by impurity atom-vacancy complexes .... See Entry 119054

Effect of γ-radiation on the electrical properties of bulk amorphous $As_4Se_2Te_4$ .... See Entry 119067

The silver iodide-thallium iodide pseudo-binary system .... See Entry 119156

Change of conduction mechanism with gamma dose of irradiated borosilicate glasses containing copper ions .... See Entry 119261

Characterizaiton of eptiaxial films of CdTe and CdS grown by hot-walled epitaxy .... See Entry 119375

Charge density wave domains in irradiated $1T$-TaS_2: relation with the transport properties .... See Entry 119485

Compensation densities in n-type $Hg_{1-x}Cd_xTe$ from transport properties of optically generated free carriers .... See Entry 119624

Effect of illumination on current-voltage characteristics of $GdIn_3S_6$ single crystals .... See Entry 119659

Analysis of mixed conduction effects in semi-insulating gallium arsenide .... See Entry 119668

Semiconductor to metal transition in $MoCl_5$ doped polyacetylene .... See Entry 119671

Semiconducting behavior of Ag_2Te thin films and the dependence of band gap on thickness .... See Entry 119726

Temperature and thickness dependence of electrical conductivity of flash-evaporated InSb films .... See Entry 119731

Critical composition of antiferromagnetic ordering in U_nxC_{1-x} .... See Entry 119841

New magnetic phase transition in manganese ferrite at low temperatures .... See Entry 119847

Dielectric, pyroelectric, and magnetic properties of $BiMn_2O_5$ crystals .... See Entry 119989

Infrared reflectance and absorption of n-type InP .... See Entry 120052

Physical and electrochemichromic properties of RF sputtered tungsten oxide films .... See Entry 120172

Growth and characterization of n-WS_2 and niobium-doped p-WS_2 single crystals .... See Entry 120229

Vapour phase growth of arsenic chalcogenide crystals and their characterization .... See Entry 120230

Transparent conducting zinc oxide and indium-tin oxide films prepared by modified reactive planar magnetron sputtering .... See Entry 120246

High-purity InP grown by hydride VPE technique with impurity gettering by indium source and oxygen .... See Entry 120258

72.20H High-field and nonlinear effects

119620 Current injection in an insulator with traps at high fields. A.S.Verma, Y.K.Sharma, S.Mohan (Dept. of Phys, RBS Coll., Agra, India).
An. Fis. Ser. B (Spain), vol.79, no.2, p.105-7 (May-Aug. 1983). [received: Oct. 1983]
Approximate solution for the current-voltage characteristic of the single injection current in solid state diodes with a single set of traps lying above the Fermi level at high fields has been given with the help of the regional approximation method. The effect of a low field region has been also included in the analysis. It is shown that the current-voltage characteristic is started from Ohm's law which finally merges into 3/2-power law trap free regime through two transition regimes. (5 refs.)

119621 Impact ionization of electrons in silicon (steady state). J.Y.Tang, K.Hess (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5139-44 (Sept. 1983).
Monte Carlo simulations of electron impact ionization in silicon are presented which include the pseudopotential band structure as well as collision broadening and higher order effects in the electron-phonon interaction. Conduction in the two lowest conduction bands of silicon is considered. The authors also present new results for the impact ionization probability and deformation potential constants which are obtained by comparing their theory with a variety of experimental results. (13 refs.)

119622 Theory of hot electron emission from silicon into silicon dioxide. J.Y.Tang, K.Hess (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5145-51 (Sept. 1983).
The authors present Monte Carlo simulations of the hot electron emission from silicon into the oxide of metal oxide silicon transistors. The calculations include the pseudopotential band structure and quantum effects such as collision broadening due to the electron-phonon interaction. As a result, the authors present a set of transport parameters which well describes all hot electron effects in silicon (including saturation velocity and impact ionization). They also show that the collision broadening effect leads to an effective barrier lowering and may require that voltages be scaled down far below the interface barrier height of ~3.1 V in order to avoid hot electron emission. (14 refs.)

A study on electron injection in KBr single crystal .... See Entry 119068

Heating and mutual drag of charge carriers and phonons in nondegenerate Kane semiconductors in strong electric and quantizing magnetic fields .... See Entry 119633

Study of space charge effects on photoconduction in amorphous $Se_{0.95}Te_{0.05}$ films using a three electrode system .... See Entry 119647

72.20J Charge carriers: generation, recombination, lifetime, and trapping

119623 Time resolved observation of geminate recombination in metal-free phthalocyanine. Z.D.Popovic (Xerox Res. Centre of Canada, Mississauga, Ontario, Canada).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.227-9 (9 Sept. 1983).
Delayed-collection-field measurements of carrier generation and delayed fluorescence in metal-free phthalocyanine have been shown to exhibit the same time dependence. This indicates the existence of geminate electron-hole pairs with survival times extending to tens of milliseconds. (8 refs.)

119624 Compensation densities in n-type $Hg_{1-x}Cd_xTe$ from transport properties of optically generated free carriers. F.J.Bartoli, C.A.Hoffman, J.R.Meyer (Naval Res. Lab., Washington, DC, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1669-71 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
Improvements to a photoneutralization technique for accurately determining compensation densities in narrow-gap $Hg_{1-x}Cd_xTe$ are discussed. A more comprehensive theoretical understanding of the electron mobility as a function of optically excited carrier density has been established, incorporating a theory for dynamic dielectric screening in the treatment of electron-hole scattering. In addition, uniform carrier generation has been demonstrated using two-photon absorption of CO_2 laser radiation for compositions in the range $0.24<x<0.27$. This eliminates the need for nonuniformity corrections to the photo-Hall data for appropriate compositions of $Hg_{1-x}Cd_xTe$. Good agreement between theory and experiment verifies the accuracy of the technique. (5 refs.)

119625 Comparison of optically modulated absorption and photoconductivity decay lifetime measurements on HgCdTe. W.A.Radford, J.F.Shanley, O.L.Doyle (Honeywell Electro-Optics Div., Lexington, MA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1700-5 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
The optically modulated absorption (OMA) effect has been examined in *p*-type ($N_A-N_D\approx2\times10^{15}$ cm^{-3}) $Hg_{0.785}Cd_{0.215}Te$. The effect has been used to measure the excess hole lifetime for temperatures between 85 and 250K. The measured lifetimes agree with the results of photoconductivity (PC) decay measurements performed on the same samples. The measured lifetimes also indicate that an Auger process is the dominant recombination mechanism at temperatures above about 150K, while a Shockley-Read-Hall process controls the lifetime below this temperature. In addition, it was found that the OMA signal exhibits extremely large phase-interference effects when coherent radiation is used for the probe beam. These effects have been both experimentally and theoretically investigated. (14 refs.)

119626 Adhesion level parameters in $TlGaS_{2x}Se_{2(1-x)}(0.1\leq x\leq1)$. S.G.Abdullaeva.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.1, p.64-6 (1983). In Russian.
The parameters of the adhesion levels in $TlGaS_{2x}Se_{2(1-x)}$ solid solutions have been determined by the method of thermostimulated freeing of the traps. By their energy position the observed adhesion levels are clearly divided into three groups: (0.23÷0.29) eV, (0.32÷0.36) eV and (0.40÷0.44) eV. The concentrations and cross-sections of these levels are evaluated. The levels in question are established to be the fast ones. (8 refs.)

119627 Minority carrier lifetime in n-type Bridgman grown $Hg_{1-x}Cd_xTe$. R.G.Pratt, J.Hewett (Philips Res. Labs., Redhill, England), P.Capper, C.L.Jones, M.J.Quelch.
J. Appl. Phys. (USA), vol.54, no.9, p.5152-7 (Sept. 1983).
Minority carrier lifetimes have been mapped on slices of *n*-type $Hg_{1-x}Cd_xTe$ ($x\sim0.3$) grown by the Bridgman technique. The mean lifetime on a slice has been measured as a function of extrinsic carrier density and composition. Lifetimes at selected positions on slices have been measured as a function of temperature down to 30K. Aging effects have also been investigated. The authors show that the lifetime variation with temperature cannot be explained by direct band-to-band recombination alone. The assumption that recombination also occurs via Shockley-Read type recombination centers, situated 10-30 meV below the conduction band edge, enables the authors to calculate theoretical values of the lifetime in good agreement with the experimental results. Such a model can also be used to explain the variation of lifetime with composition. (23 refs.)

119628 A new static method for measuring minority carrier lifetime. J.-C.Manifacier, Y.Moreau, H.K.Henisch (Dept. of Phys., Pennsylvania State Univ., University Park, PA, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5158-60 (Sept. 1983).
Describes the theory of a new static lifetime measurement, carried out by means of potential probes in the vicinity of a current-carrying contact on a high-lifetime semiconductor, with and without traps. It is based on recognition of the fact that, in the presence of minority carrier injection, a uniform field is obtained only for a particular current density, and that depends directly on the carrier lifetime. (10 refs.)

119629 Dependence of the ambipolar diffusion in silicon on the carrier density. H.Bergner, V.Bruckner (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K85-8 (Sept. 1983).
Using the excite-and-probe technique it is possible to perform time-resolved reflectivity measurements on a picosecond time scale where recombination in undoped monocrystalline silicon is negligible. The authors have utilized this property to study experimentally for the first time the diffusion process of the carriers into the bulk in silicon at extremely high carrier densities. (5 refs.)

119630 Passivation of intragrain defects by copper diffusion in p-type polycrystalline silicon. M.Zehaf, G.Mathian, C.M.Singal, S.Martinuzzi (Lab. de Photoelectricite, Faculte des Sci. et Tech. de Marseille, Marseille, France).
Rev. Phys. Appl. (France), vol.18, no.9, p.557-60 (Sept. 1983).
In order to passivate structural defects which degrade electronic properties, copper is diffused in p-type Wacker polysilicon at low temperature (≤500°C). Copper diffused samples exhibit homogeneous values of effective minority carrier diffusion lengths, which are practically as high as the values measured in the starting material. Light beam induced current scannings indicate that the grain responses are improved after copper diffusion while the grain boundary recombination activity is enhanced. (10 refs.)

119631 Photoinduced absorption study of recombination in amorphous Si:H doped with P or B. D.Pfost, J.Tauc (Dept. of Phys., Brown Univ., Providence, RI, USA).
Solid State Commun. (USA), vol.48, no.2, p.195-8 (Oct. 1983).
The decay of the photoinduced midgap absorption band was studied in *a*-Si:H doped with P and B and compared with the decay in undoped *a*-Si:H and in *a*-Si:H with a high concentration of dangling bonds produced by electron irradiation. At high temperatures, recombination controlled by multiple trapping transport is observed in most samples. At low temperatures an additional recombination process is observed and attributed to tunneling which increases with doping. The temperature dependence of the decays correlates with dangling bond density produced by doping or irradiation. (15 refs.)

Gain and carrier lifetime measurements in AlGaAs single quantum well lasers .... See Entry 118142

Doping of $(CH)_x$ films with lanthanides salts .... See Entry 119045

^{60}Co γ-ray and electron irradiation damage of GaAs single crystals and solar cells .... See Entry 119066

Characterizaiton of eptiaxial films of CdTe and CdS grown by hot-walled epitaxy .... See Entry 119375

Deep centers in gold-doped HgCdTe .... See Entry 119503

Characterization of deep energy levels in mercuric iodide .... See Entry 119508

Dynamic dielectric response to carrier-carrier interactions in narrow-gap semiconductors .... See Entry 119594

The scattering of charge carriers in large electron-hole drops in germanium .... See Entry 119595

Current injection in an insulator with traps at high fields .... See Entry 119620

Generation, investigation and application of laser-induced charge carrier plasmas in semiconductors .... See Entry 119642

Surface and interface recombination in thin film HgCdTe photoconductors .... See Entry 119645

Photoeffects in cadmium sulfide and sulfoselenide powders: a reexamination by microwave photoconductivity .... See Entry 119649

Charge carrier photogeneration in iodoform. Applicability of the Onsager model ....See Entry 119650

Spectroscopic analysis of transient photocurrents in a-As_2Se_3 ....See Entry 119651

Measurement of the decay time constant of photoconductors ....See Entry 119664

Deep centers in semiconductor devices: mean lifetime control ....See Entry 119700

A study on the purity and SIMS profiling of MOVPE-cadmium mercury telluride ....See Entry 119723

Minority carrier lifetime in LPE $Hg_{1-x}Cd_xTe$ ....See Entry 119724

Electron trapping/detrapping within thin SiO_2 films in the high field tunneling regime ....See Entry 119733

Modeling of thermally stimulated currents in polytetrafluoroethylene ....See Entry 119983

Latest developments in the growth of $Cd_xHg_{1-x}Te$ and CdTe-HgTe superlattices by molecular beam epitaxy ....See Entry 120251

Horizontal slider LPE of (HgCd)Te ....See Entry 120266

Semiconductor properties of the anodic polymer obtained on platinum from selenocyanate ammoniate ....See Entry 120632

72.20M Galvanomagnetic and other magnetotransport effects

119632 Transverse magnetoresistance and Hall effect in wide-gap, p-type $Hg_{1-x}Mn_xTe$. J.R.Anderson, W.B.Johnson (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA), D.R.Stone.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1761-4 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
A low frequency AC measuring-current technique has been used to investigate the magnetoresistance and Hall effect in $Hg_{1-x}Mn_xTe$ over a temperature range from 2 to 300K. The exchange interaction between the Mn^{++} ions and the band carriers causes the energy bands to be significantly modified in the presence of a magnetic field. As a result magnetic boil-off and magnetic-field-enhanced hopping have been observed in *p*-type semiconducting samples. These effects produce a large decrease of resistance with increasing magnetic field at low temperatures. (13 refs.)

119633 Heating and mutual drag of charge carriers and phonons in nondegenerate Kane semiconductors in strong electric and quantizing magnetic fields. T.M.Gasymov, F.K.Kocharli.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.1, p.72-8 (1983). In Russian.
The influence of the mutual drag of heated carriers and phonons on galvanomagnetic effects in the nondegenerate semiconductors having a Kane spectrum of electrons being in strong electric E and quantizing magnetic H fields is considered. It is found that far from the acoustic instability the current density increases with E and approaching the acoustical instability point $j \sim E^2$. At the nearest vicinity of the acoustic instability point the curent reaches saturation. (10 refs.)

119634 Temperature dependence of $Bi_{0.92}Sb_{0.08}$ alloy galvanomagnetic coefficients in a weak magnetic field within the region from 77 to 300K. A.A.Musaev, B.A.Tairov, M.G.Shakhtakhtinskii.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.1, p.79-83 (1983). In Russian.
Temperature dependencies of the concentration and mobilities of the electrons and holes within the range from 77 to 300K are given on the basis of the measured galvanomagnetic coefficients for a $Bi_{0.92}Sb_{0.08}$ alloy. An essential decrease in the mobility of the electrons with temperature is assumed to be due to intervalley scattering by optical phonon. (8 refs.)

119635 Defect chemistry and intrinsic carrier concentration for $Hg_{1-x}Cd_xTe(s)$ for x=0.20, 0.40, and 1.0. Ching-Hua Su, Pok-Kai Liao, R.F.Brebrick (Coll. of Engng., Marquette Univ., Milwaukee, WI, USA).
J. Electron. Mater. (USA), vol.12, no.5, p.771-826 (Sept. 1983).
The theoretical equations governing the crystal-vapor equilibrium for $Hg_{1-x}Cd_xTe(s)$ are summarized for a model with double-ionized native defects and applied to the data for x=0.20, 0.40, and 1. The basic equations are shown to contain those used elsewhere as special cases. Low temperature Hall mobility data are analysed. Allowing the intrinsic carrier concentration, n_i, to vary, but under constraints, to obtain an optimum fit and assuming a non-degenerate semiconductor, the hole concentration-mercury pressure isotherms can be fitted satisfactorily and better than before. (36 refs.)

119636 Corbino resistance of iodine doped polyacetylene. W.Ross, A.Philipp, K.Seeger (L. Boltzmann Inst. fur Festkorperphys., Wien, Austria).
J. Phys. Colloq. (France), vol.44, no.C-3, p.127-30 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Both the Corbino resistance and the magnetoresistance of compacted and uncompacted iodine-doped polyacetylene $(CHI_y)_x$ were measured at different dopant levels in the range $0.13 \leq y \leq 0.3$ at temperatures between 4.2K and 40K. A comparison of the two phenomena for the case of positive Corbino- and magnetoresistance yields a mobility of the carriers which at 4.2K is on the order of 10^2 cm^2 V^{-1} sec^{-1}. The negative part of the magnetoresistance in uncompacted samples with $y \geq 0.2$ is tentatively explained by spin-splitting in a two-band model. (6 refs.)

119637 Quantization of the Hall conductance in a two-dimensional electron gas. G.F.Giuliani, J.J.Quinn, S.C.Ying (Dept. of Phys., Brown Univ., Providence, RI, USA).
Phys. Rev. B (USA), vol.28, no.6, p.2969-78 (15 Sept. 1983).
The authors present a microscopic theory of the Hall conductance in a two-dimensional electron gas. Their approach is based on a single-particle picture and explicitly accounts for the effects of a random impurity potential. Within the geometry introduced by Laughlin a general expression is derived from which it is possible to evaluate the Hall conductance in terms of the properties of the electronic spectrum at the Fermic energy for any value of the magnetic field. When the chemical potential lies between the bulk extended states of well-defined neighboring Landau bands, the Hall conductance is quantized in integral multiples of e^2/h, even in the presence of a large density of localized states. Within their model the exactness of this quantization depends on the shape of the confining potential, the thickness of the sample, and the magnetic field. (26 refs.)

119638 Hall-coefficient factor and inverse valence-band parameters of holes in natural diamond. L.Reggiani (Istituto di Fisica, Univ. di Modena, Modena, Italy), D.Waechter, S.Zukotynski.
Phys. Rev. B (USA), vol.28, no.6, p.3550-5 (15 Sept. 1983).
In strict analogy with the case of silicon, the Hall-coefficient factor of holes in natural diamond is found to be systematically less than unity in the range of temperature $100 < T < 1000K$ investigated here. A microscopic interpretation is shown to provide information on the reliability of a different set of inverse valence-band parameters which can be found currently in the literature. Agreement between theory and experiment confirms the values $|A|=3.61$, $|B|=0.18$, and $|C|=3.76$ deduced from pseudopotential band-structure calculations. (23 refs.)

119639 Hall effect in α-$RuCl_3$. S.Rojas, G.Spinolo (Dipartimento de Fisica, Univ. di Milano, Milano, Italy).
Solid State Commun. (USA), vol.48, no.4, p.349-51 (Oct. 1983).
The Hall effect measurements performed in the layer compounds α-$RuCl_3$ show that, in the sheets perpendicular to the c-axis, $\mu(300K) \simeq 0.2$ cm^2V sec^{-1}; the temperature dependence of μ appears to be $\mu(T)=\mu_0 T^{-n}$, with $n=2.3 \pm 0.1$, in the 180-320K range. The transport appears to be due to electrons that move with a band type of mechanism, the main scattering process being due to the homopolar high energy phonons which modulate the thickness of the layers. (12 refs.)

The effect of annealing on the defect structure and electrical properties of deformed single crystals of Ge ....See Entry 119019

Some aspects of Li behavior in ion implanted HgCdTe ....See Entry 119052

Growth and photoluminescence spectra of high-purity liquid phase epitaxial $In_{0.53}Ga_{0.47}As$ ....See Entry 119363

Transport properties and Fermi surfaces in $HfTe_5$ and $ZrTe_5$ ....See Entry 119403

Energy band structure and electronic transport properties of niobium monoxide ....See Entry 119429

Unified theory of AC and DC hopping conductivity in disordered systems ....See Entry 119535

The scattering of charge carriers in large electron-hole drops in germanium ....See Entry 119595

Electrical transport properties of iodine doped polyacetylene ....See Entry 119603

Electrical properties of vapour phase grown $(ZnSe)_x(CdTe)_{1-x}$ single crystals ....See Entry 119618

Investigation of persistent photoconductivity in Si-doped *n*-$Al_xGa_{1-x}As$ grown by molecular beam epitaxy ....See Entry 119643

Analysis of mixed conduction effects in semi-insulating gallium arsenide ....See Entry 119668

Theory of the magnetophonon effect for the two-dimensional electron gas in semiconducting heterostructures ....See Entry 119698

Two-dimensional magneto-quantum transport on GaAs-$Al_xGa_{1-x}As$ heterostructures under non-ohmic conditions ....See Entry 119699

The physics and applications of the two-dimensional electron gas ....See Entry 119707

A study on the purity and SIMS profiling of MOVPE-cadmium mercury telluride ....See Entry 119723

New magnetic phase transition in manganese ferrite at low temperatures ....See Entry 119847

Radio-frequency sputtered indium tin oxide thin films ....See Entry 120248

Latest developments in the growth of $Cd_xHg_{1-x}Te$ and CdTe-HgTe superlattices by molecular beam epitaxy ....See Entry 120251

Horizontal slider LPE of (HgCd)Te ....See Entry 120266

72.20P Thermoelectric effects

119640 Measurement and interpretation of thermopower in oxides. A.Trestman-Matts, S.E.Dorris, T.O.Mason (Dept. of Materials Sci. & Engng., Northwestern Univ., Evanston, IL, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.589-92 (Aug. 1983).
The influence of point-defect gradients on thermoelectric coefficient measurements in oxides is quantified. This permits corrections to be made for data collected by conventional means and suggests alternative techniques of thermopower measurements which maintain the average sample temperature while imposing thermal gradients. Experimental results on CoO, Fe_3O_4, and FeO in equilibrium with various atmospheres are considered. (12 refs.)

Preparation and properties of sputtered a-Si:H:F films ....See Entry 119376

Pressure effects in $HfTe_5$ and $ZrTe_5$ ....See Entry 119612

Mixed electrical conduction in sintered BCC $6Bi_2O_3.SiO_2$ .....See Entry 119669

Electrical conduction in β-Bi_2O_3 doped with Sb_2O_3 ....See Entry 119670

Semiconductor to metal transition in $MoCl_5$ doped polyacetylene ....See Entry 119671

72.30 HIGH-FREQUENCY EFFECTS; PLASMA EFFECTS

119641 Electrodynamical domains in metal plates. V.T.Dolgopolov, P.N.Chuprov (Inst. of Solid State Phys., Acad. of Sci., Chernogolovka, USSR).
Solid State Commun. (USA), vol.48, no.2, p.165-7 (Oct. 1983).
It is experimentally revealed that part of the DC current appearing due to the rectification of the RF current in the skin-layer may close through the bulk of the specimen. As a result, the specimen is broken up into electrodynamic domains differing in the value of the macroscopic magnetic moment. (5 refs.)

119642 Generation, investigation and application of laser-induced charge carrier plasmas in semiconductors. H.Bergner, V.Bruckner, B.Schroder (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.113-24 (1983). In English.
By means of modelocked solid state lasers it is possible to generate high free charge carrier densities ($\sim 10^{20}$ cm^{-3}) in semiconductors. It leads to changes of both the optical and the electrical properties of the semiconductor sample. Using time resolved reflectivity measurements the lifetime of optically generated charge carriers was determined in the ps time scale. Experimental results for monocrystalline, polycrystalline and amorphous silicon and for GaAs are presented using a ps-Nd:YAG laser. Theoretical and experimental results on the time behaviour of charge carrier are demonstrated taking into

account the influence of the exciting pulse duration. Optoelectronic switches were also investigated using the second harmonic radiation of a Nd:YAG laser to switch a semiconductor shutter. Electrical pulses with peak voltages of 250 V and with rise times of subnanoseconds were generated. (20 refs.)

Phonons, phonon focusing, and helicon-phonon interaction .... See Entry 119119

Theory of hot electron emission from silicon into silicon dioxide .... See Entry 119622

Theory of anomalous acoustical skin effect in metals .... See Entry 119666

Resonant tunneling through quantum wells at frequencies up to 2.5 THz .... See Entry 119691

Gain saturation in photoexcited semiconductors ....See Entry 120113

Direct luminescence evidence for the degenerate electron-hole plasma formation in $A^{II}B^{VI}$ semiconductors .... See Entry 120140

72.40 PHOTOCONDUCTION AND PHOTOVOLTAIC EFFECTS; PHOTODIELECTRIC EFFECTS

119643 Investigation of persistent photoconductivity in Si-doped *n*-$Al_xGa_{1-x}As$ grown by molecular beam epitaxy. H.Kunzel, A.Fischer, J.Knecht, K.Ploog (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Appl. Phys. A (Germany), vol.A32, no.2, p.69-78 (Oct. 1983).
The persistent photoconductivity effect in Si-doped *n*-$Al_xGa_{1-x}As$ layers grown by molecular beam epitaxy on (100)GaAs substrates has been investigated by detailed Hall-effect and capacitance measurements at 10-300K. In the alloy composition range $0.25<x<0.40$ the electrical properties of *n*-$Al_xGa_{1-x}As$ are governed by a deep electron trap having an emission barrier of 0.34-0.40 eV (depending on the doping concentration), as determined by admittance measurements. The concentration of deep electron traps, deduced from low-temperature capacitance measurements, is found to coincide with the amount of persistent photoconductivity observed in the material. (27 refs.)

119644 Effect of applied bias voltage on photocurrent of Si photocell. T.Ugumori (Tech. Coll., Yamaguchi Univ., Ube, Yamaguchi, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1223 (July 1983).
The effect of an applied bias voltage on the photocurrent from an Si photocell has been examined to confirm the band bending mechanism. A conventional Sharp SPD-110 Si photocell was employed as a specimen. (3 refs.)

119645 Surface and interface recombination in thin film HgCdTe photoconductors. R.D.Graft, F.F.Carlson, J.H.Dinan, P.R.Boyd, R.E.Longshore (US Army Night Vision, Electro-Optics Lab., Fort Belvoir, VA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1696-700 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
A method is described for the separation of bulk and surface recombination parameters using experimentally measured photoconductive decay curves. Curve fitting procedures using numerical solutions to the time dependent hole continuity equation permit a unique determination of surface recombination velocities and bulk lifetime. The method is applied to thick and thin films of HgCdTe to determine recombination velocities at several technologically important interfaces. Values of recombination velocity ranged from 300 to 20000 cm/s depending upon material growth method and surface preparation. Experimentally observed deviations from the assumed model are discussed in terms of a spatially dependent bulk lifetime. (12 refs.)

119646 Phototransients in anodic tantalum oxide thin films. W.H.Bokhari, F.M.Nazar (Centre for Solid State Phys., Punjab Univ., Lahore, Pakistan).
Int. J. Electron. (GB), vol.55, no.4, p.647-51 (Oct. 1983).
Phototransients under radiation of 274 nm have been studied in anodic tantalum oxide thin films. The area under the phototransient curves, the relaxation time and the decay time are found to decrease with the applied field. For short times $\Delta I\alpha$ exp $(-t/\tau)$ with τ decreasing with field, while for longer times there is a departure from exponential behaviour. These phototransients may be due to the drift of photoexcited electrons under the action of an applied field and their subsequent retrapping. (14 refs.)

119647 Study of space charge effects on photoconduction in amorphous $Se_{0.95}Te_{0.05}$ films using a three electrode system. M.Noda (Technol. Dept., Aichi Univ. of Education, Aichi, Japan), K.C.Kao, L.Chow.
Int. J. Electron. (GB), vol.55, no.4, p.661-7 (Oct. 1983).
An experimental study of space charge effects on photoconduction in amorphous $Se_{0.95}Te_{0.05}$ films has been made using a three electrode system. The results indicate that the photoconduction in this material is dominated by holes and is governed by the built-in field created by space charges and the carrier injection from the electrical contacts, and that the three electrode system can be used for the investigation of the behaviour of space charges. (3 refs.)

119648 Photoionization cross section of electron irradiation induced levels in silicon. S.D.Brotherton, G.J.Parker, A.Gill (Philips Res. Labs., Redhill, England).
J. Appl. Phys. (USA), vol.54, no.9, p.5112-16 (Sept. 1983).
Transient photocapacitance measurements have been made on 12-MeV electron irradiated silicon diodes. Both *p*- and *n*-type substrates were used in order to investigate the centers in both halves of the band gap. Photoionization cross sections were measured on two divacancy levels at $E_v+0.20$ eV and $E_c-0.23$ eV, the A center ($E_c-0.17$ eV), and further levels at $E_c-0.09$ eV and $E_v+0.35$ eV. The only center likely to be a useful counterdopant for a 3-5 μm extrinsic silicon imaging device is the divacancy at $E_v+0.20$ eV. (21 refs.)

119649 Photoeffects in cadmium sulfide and sulfoselenide powders: a reexamination by microwave photoconductivity. D.H.Klosterboer, W.L.Meissner, M.R.V.Sahyun (Sci. Res. Lab., 3M Co., St. Paul, MN, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5161-70 (Sept. 1983).
Cu doped CdS powders in electrophotographic devices have been characterized using the flash microwave photoconductivity method. The signals representative of these materials exhibited minima, as well as maxima, in microwave absorption, hence conductivity; the former were identified with the slow thermalization of deep trapped electrons, which allowed the trapping characteristics of the samples to be inferred. Correlation of the microwave photoconductivity results with electrophotographic measurement elucidated the role of the trapping states in interfering with electrophotographic response. From temperature and wavelength dependence of the photoconductivity it was inferred that (except at low temperatures) the conduction band is not populated directly on light absorption, even of band-gap wavelengths. A kinetic analysis revealed that the observed decay of the photoconductivity was controlled by hole trapping at the Cu(I) centers in the powder; thus the experimental data could be used to reveal a two-stage mechanism for hole trapping, and some features of the potential surface associated therewith are inferred. (32 refs.)

119650 Charge carrier photogeneration in iodoform. Applicability of the Onsager model. S.Nespurek (Inst. of Macromolecular Chem., Czechoslovak Acad. of Sci., Prague, Czechoslovakia), A.Samoc, M.Samoc, J.Sworakowski.
J. Chem. Phys. (USA), vol.79, no.6, p.3104-12 (15 Sept. 1983).
The photogeneration of electrons and holes in thin layers of iodoform has been investigated as a function of the electric field by the method of photoinduced discharge current. The experimental results can be described by the Onsager theory. The fraction of absorbed photons which produce thermalized electron-hole pairs is close to unity. The pair separation distance is ~3 nm. Equal values of the primary rates of production of electrons and holes support the idea of an intrinsic photogeneration mechanism. (32 refs.)

119651 Spectroscopic analysis of transient photocurrents in a-As_2Se_3. H.Michiel, G.J.Adriaenssens, J.M.Marshall (Lab. voor Vaste Stof en Hoge Drukfysika, Katholeke Univ., Leuven, Leuven, Belgium).
J. Phys. C (GB), vol.16, no.28, p.L1005-10 (10 Oct. 1983).
A recently developed spectroscopic method, based on trap-controlled band-transport (TCBT) in semiconductors, is applied to the transient photocurrent in glassy As_2Se_3. The analysis points to the presence of a local maximum in the density of localised states at some 0.45 eV inside the gap; beyond this maximum, the density decreases exponentially over a range of ~0.15 eV. Difficulties concerning the spectroscopic interpretation of transport data are further examined. (18 refs.)

119652 Anomalous photovoltaic effect in thin films of ZnSe obliquely deposited in vacuum. A.A.El-Shazly (Faculty of Education, Ain Shams Univ., Cairo, Egypt), M.A.Kenawy, H.T.El-Shair, M.M.El-Nahass, H.S.Soliman.
J. Phys. D (GB), vol.16, no.10, p.1967-76 (14 Oct. 1983).
An anomalous photovoltaic effect (APE) has been observed in thin films of zinc selenide obliquely deposited in vacuum for the first time. Photovoltages of up to 70 V have been measured in some samples. The effect is influenced strongly by some experimental parameters. The changes in the photovoltages may be attributed to the film structure which has been investigated during the course of this study. (6 refs.)

119653 Photocondutivity of polyacetylene. G.Guillaud, M.Maitrot (Univ. Claude Bernard, Lyon, France), J.Davenas, X.L.Xu, B.Francois, C.Mathis, J.J.Andre.
J. Phys. Colloq. (France), vol.44, no.C-3, p.101-5 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors present a study of the photoconductivity of polyacetylene samples versus the cis-trans ratio. The transitory effect appears for a weak trans percentage. The traps play an increasing part when the isomerization is larger. (7 refs.)

119654 Photogeneration of solitons in trans-$(CH)_x$: the reversed spin-charge relation of the photoexcitations. J.D.Flood, A.J.Heeger (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.397-401 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
High sensitivity ESR studies of trans-$(CH)_x$ have been carried out during photoexcitation with $h\omega>E_g$. The results set an upper limit on the number of photoinduced spins and on the quantum efficiency for photoproduction of unpaired spins. The authors conclude that the charged photoexcitations are spinless and therefore have the reversed spin-charge relation of solitons. The photogeneration branching ratio, charged solitons to neutral solitons, is greater than 10^2. (21 refs.)

119655 Photoproduction of neutral versus charged solitons in trans $(CH)_x$. R.Ball, W.P.Su, J.R.Schrieffer (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.429-35 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The branching ratio R for the photoproduction of neutral soliton-antisoliton pairs ($S^0\bar{S}^0$) versus charged pairs ($S^{\pm}\bar{S}^{\mp}$) is calculated for pristine trans-polyacetylene. Within the SSH model, the authors find R vanishes in the adiabatic approximation as a consequence of inversion symmetry (parity) and the Pauli principle. If one includes nonadiabatic effects, R remains zero at least to second order in the electron-phonon interaction as a consequence of charge conjugation symmetry. Thus, neutral $S\bar{S}$ photoproduction is strongly suppressed in $(CH)_x$, in agreement with experiments by Flood, et al. (3 refs.)

119656 Photogeneration and geminate recombination of charge carriers in a quasi-one-dimensional system. A.S.Siddiqui (Dept. of Phys., Univ. of Essex, Colchester, England).
J. Phys. Colloq. (France), vol.44, no.C-3, p.495-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
In a quasi-one-dimensional system the photogeneration rate for excess free carriers is expected to be dependent on the applied electric field. This leads to a number of novel features in the photoconductive behaviour of a 1-D material, particularly in the presence of deep trapping centres. The author describes the expected photoconductive response of such a system in detail as a function of light intensity, polarisation, applied electric field and the direction of current flow. These expectations, valid for all 1-D systems, are then compared with the experimental data presented for the quasi 1-D single crystal polymer polydiacetylene-toluene sulphonate. The experimental results indicate that, for the 1-D case, the quantum efficiency for free carrier generation has a minimum non-zero value in the low field limit which may be comparable with that in the 3-D case. This necessitates a modification, in the low field limit, of the presently accepted 1-D version of the Onsager theory of geminate recombination. (2 refs.)

119657 Photoconductivity in oriented polymers and liquid crystalline model compounds containing carbazole. L.L.Chapoy, D.K.Munck (Inst. for Kemiindustri, Tech. Univ. of Denmark, Lyngby, Denmark).
J. Phys. Colloq. (France), vol.44, no.C-3, p.697-700 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Interest in photoconductive polymers has been mainly related to poly(N-vinylcarbazole), PVK, and in particular to carbazole, the active light sensitive chromophore in PVK. Inherent, structural defects in PVK, i.e. conformational distributions, imperfect tacticity and finite chain lengths are thought to inter-

fere with the charge carrier mobility. Novel systems, amenable to the investigation of the influence of ordered arrays of carbazole chromophores on the photoconductivity are presented. Preliminary results for the photoconductivity of carbazole doped nematic liquid crystals are given. (16 refs.)

119658 Photovoltaic effects in liquid crystal cells containing organic dyes. S.Sato, S.Fukuda (Dept. of Electronic Engng., Mining Coll., Akita Univ., Akita, Japan).

Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.99-108 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).

Dye sensitization on photovoltaic phenomena under visible light stimulation are described in smectic, nematic, and isotropic phases of p-cyano-p′-n-octylbiphenyl cells with a symmetrical electrode arrangement. Methyl red is used as a sensitizer. The dependence of short-circuit photocurrents on excitation light intensity, light pulse width, temperature, and the cell thickness are measured. The photocurrent consists of three components, that is, the small negative peak with a fast response, the second positive peak following after the first peak, and the third negative peak with a slow response. The second and the third components of the photocurrents cannot be observed in the solid crystalline state. Both of them decrease with an increase in the cell thickness, and their response time becomes shorter as the temperature rises. These two components are induced by the diffusion processes of the carriers produced by the light stimulation. (4 refs.)

119659 Effect of illumination on current-voltage characteristics of $GdIn_3S_6$ single crystals. G.M.Guseinov, G.M.Niftiev, M.G.Shakhtakhtinskii (Inst. of Phys., Acad. of Sci., Baku, Azerbaidzhan SSR).

Phys. Status Solidi a (Germany), vol.79, no.1, p.K53-5 (Sept. 1983).

Presents an investigation of the current voltage characteristics (CVC) of $GdIn_3S_6$ compounds in three states (dark states, residual-conductivity (RC) state, i.e. dark state after preliminary bias lighting, and illuminated state). It was noted that under the effect of an electric field of strength 4.4×10^3 V/cm the specimen passes from a more photoconductive to a less photoconductive state, i.e. an N-like CVC is observed, and as this takes place, one can see a growth of the currents corresponding to the points of transition from the high-conductivity to the low-conductivity state. (6 refs.)

119660 Photovoltaic behaviour of rhodamine 6G Schottky-type cells. J.Muto, Y.Tsunekawa (Instrumentation Engng., Faculty of Engng., Keio Univ., Yokohama, Japan).

Phys. Status Solidi a (Germany), vol.79, no.1, p.K109-12 (Sept. 1983).

Rhodamine 6G (Rh6G) is an organic dyestuff, belonging to the xanthene family and is widely used as a laser dye material. The authors have fabricated Rh6G thin film sandwich cells and examined their photovoltaic properties. Rh6G was evaporated in vacuum from a Ta crucible on a transparent conducting coating (SnO_2) glass. A film of Al was subsequently evaporated on top of the organic solid. Photovoltaic behaviours of the cells were examined in vacuum of 10^{-2} Torr and the irradiation of light was done through the glass electrode of the cell. (6 refs.)

119661 Photoconductivity and the evolution of energy bands in fluid xenon. R.Reininger, U.Asaf, I.T.Steinberger (Racah Inst. of Phys., Hebrew Univ., Jerusalem, Israel), V.Saile, P.Laporte.

Phys. Rev. B (USA), vol.28, no.6, p.3193-9 (15 Sept. 1983).

Photoconductivity excitation spectra for densities above 10^{21} atoms/cm^3 up to the triple point exhibit a threshold that moves to lower photon energies with increasing density. Its value extrapolated to zero density is 11.10 eV, i.e. the difference between the energy minimum of the $Xe_2{}^+$ molecular ion and the ground-state energy of the xenon atom. The hole polarization energy P^+ was evaluated using the Born charging energy for the same density range. These results along with the previously determined values of the electron affinity V_0 yielded a full representation of the energy-band edges for the whole density range. The relationship between these results and those on the evolution of excitons is discussed in detail. (23 refs.)

119662 Wide optical gap, undoped, photoconductive a-Si_xN_{1-x}:H prepared by DC sputtering. R.Meaudre, J.Tardy (Dept. de Phys. des Materiaux, Univ. Claude Bernard de Lyon, Villeurbanne, France).

Solid State Commun. (USA), vol.48, no.2, p.117-19 (Oct. 1983).

The effect of nitrogen in hydrogenated amorphous silicon (a-Si:H) has been investigated on thin films produced by DC sputtering in a $Ar+N_2+H_2$ gas mixture. The optical bandgap is seen to increase linearly from 1.85 eV to 2.3 eV as the $P(N_2)/P_{total}$ ratio increases from 0 to 0.013. AM-1 photoconductivity is better than that of undoped a-Si_xC_{1-x}:H films and is very close to that of these B doped films though no doping effect is observed. The normalized photoconductivity $\eta\mu\tau$ corresponding to a 10^4 cm^{-1} optical absorption coefficient compares favourably with that of undoped a-Si_xC_{1-x}:H films. (13 refs.)

119663 Spectral dependences of the photoconductivity of thin cadmium-doped Dy_2S_3 and Yb_2S_3 films. L.N.Glurdzhidze, D.G.Gzirishvili, Z.U.Dzhabua, T.O.Dadiani, V.V.Sanadze (V.I. Lenin Polytech. Inst., Tbilisi, Georgian SSR).

Sov. Phys.-Solid State (USA), vol.25, no.3, p.539-40 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.935-6 (March 1983). [received: Oct. 1983]

The authors report the results of a determination of the spectral dependences of the photoconductivity of cadmium-doped thin films of dysprosium and ytterbium sesquisulfides. Measurements of the photoconductivity were made by a method described by Glurdzhidze et al. (1980, 1981) at photon energies of 0.2-3.3 eV and temperatures 115-500K. The numerical values of the photoconductivity were calculated by dividing by the same number of photons corresponding to the 0.1 W/cm^2 intensity of the radiation incident on a film. (11 refs.)

119664 Measurement of the decay time constant of photoconductors. D.Langbein.

Wiss. Z. Tech. Hochsch. Ilmenau (Germany), vol.29, no.3, p.133-43 (1983). In German.

It is suggested that the decay curves of square wave light excited semiconductors can give information on recombination processes. The decay was found from the change of Q-factor of a microwave resonator loaded with the photo-conductor. The theory of Q-factor dependence of a low-loss cavity on internal loading is developed and methods of using reflection coefficient to find loading are stated. A measuring arrangement is illustrated, which was used in the 30 MHz region. Optical excitation was by infrared square waves from a pair of type LD271 light emitting diodes. It is noted that the resonator method should make it possible to measure semiconductor carrier lifetime by a non-contact method. (13 refs.) *G.M.E.*

The preparation and characterization of strained-layer superlattices in the GaAs+GaP system .... See Entry 119365

Preparation and properties of sputtered a-Si:H:F films .... See Entry 119376

Characterization of deep energy levels in mercuric iodide ...... See Entry 119508

Electrical, optical and glass transformation properties of amorphous solids—a review .... See Entry 119543

DC and microwave conductivity of $FeCl_3$-doped polyparaphenylene $(p\text{-}C_6H_4)_x$ .... See Entry 119561

Electrical conduction mechanism in crystal violet dye sensitised with AgI .... See Entry 119601

Amorphous silicon-phosphorus layer .... See Entry 119613

Comparison of optically modulated absorption and photoconductivity decay lifetime measurements on HgCdTe .... See Entry 119625

Surface photovoltage spectroscopy and thermally stimulated contact potential difference studies of real ZnS surfaces .... See Entry 119681

HgCdTe heterojunctions .... See Entry 119693

Persistent photoconductivity in (Al,Ga)As/GaAs modulation doped structures: dependence on structure and growth temperature .... See Entry 119696

Influence of hydrogen reduction on photoelectrochemical behavior of anodic oxidized n-TiO_2-layers .... See Entry 119705

Growth and characterization of n-WS_2 and niobium-doped p-WS_2 single crystals .... See Entry 120229

Vapour phase growth of arsenic chalcogenide crystals and their characterization .... See Entry 120230

Review of conductor-polymeric semiconductor solar cells ...... See Entry 120738

72.50 ACOUSTOELECTRIC EFFECTS

119665 Nonlinear theory of propagation of sound of intermediate frequency. V.D.Kagan (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).

Sov. Phys.-Solid State (USA), vol.25, no.3, p.375-7 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.658-61 (March 1983). [received: Oct. 1983]

When an acoustic wave of intermediate frequency interacts with electrons, the component of the electron distribution function averaged over a constant-energy surface does not reach equilibrium during the period of the acoustic wave. As a result, the acoustic wave interacts with electrons described by such a nonequilibrium distribution function rather than with the average electron density. Since acoustic waves influence strongly electrons with low energies, the nonlinearity parameter exceeds the density nonlinearity parameter. (7 refs.)

119666 Theory of anomalous acoustical skin effect in metals. G.I.Ivanovski (Inst. for Phys. Problems, Acad. of Sci., USSR), M.I.Kaganov.

Sov. Phys.-JETP (USA), vol.56, no.6, p.1345-9 (Dec. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.6, p.2320-8 (Dec. 1982). [received: Oct. 1983]

The distribution of the displacement field u(z) in a metallic halfspace $z>0$ is calculated for the case in which a transverse sound wave of frequency ω is excited at the boundary; the frequency satisfies the condition $\omega\tau\gg1$, where τ is the conduction electron mean free path time. It is shown that the electrons whose velocity is parallel to the wave vector 'drag' the displacement wave over a distance $z\sim l=v_F\tau$ (v_F is the Fermi velocity). In the collisionless limit $(l\rightarrow\infty)$ the sound wave decays nonexponentially. (15 refs.)

Heating and mutual drag of charge carriers and phonons in nondegenerate Kane semiconductors in strong electric and quantizing magnetic fields .... See Entry 119633

Echo phenomena in piezoelectric powders .... See Entry 119984

Investigation of ferroelectric phase transitions in powdered TGS using electroacoustic echo .... See Entry 119991

72.55 MAGNETOACOUSTIC EFFECTS

Magnetoacoustic excitation of coherent spin waves in antiferromagnets .... See Entry 119829

72.60 MIXED CONDUCTIVITY AND CONDUCTIVITY TRANSITIONS

119667 Electrical switching in silver chloride. A.Friedenberg, Y.Shapira (School of Engng., Tel Aviv Univ., Ramat Aviv, Israel).

J. Appl. Phys. (USA), vol.54, no.9, p.5171-5 (Sept. 1983).

Observation of threshold switching is reported in AgCl. Subsequent to a forming process, switches are developed from AgCl samples of various crystalline structures. The switching dynamics as well as the relevant electrical properties are characterized. During the forming process Ag dendrites are believed to form by an electrolytic process. The principal ON state current channel bridges the dendrites via a thermal or an electronic mechanism. (13 refs.)

119668 Analysis of mixed conduction effects in semi-insulating gallium arsenide. J.J.Winter, H.A.Leupold, R.L.Ross, A.Ballato (US Army Electronics Technol. & Devices Lab., Fort Monmouth, NJ, USA).

J. Appl. Phys. (USA), vol.54, no.9, p.5176-82 (Sept. 1983).

Hall effect and conductivity measurements made on semi-insulating bulk GaAs are examined by a new approach to mixed conduction analysis. Based on Fermi level and electron mobility analyses of conductivity and Hall coefficient, it uses revised values of effective densities of states at the band edges and electron/hole mobility ratios recently adopted by other workers. The treatment provides a visual analysis of the system in terms of the electrical parameters and impurity densities, and establishes criteria for the onset of mixed conduction. (19 refs.)

119669 Mixed electrical conduction in sintered BCC $6Bi_2O_3.SiO_2$. M.Miyayama, Y.Suenaga, H.Yanagida (Dept. of Industrial Chem., Univ. of Tokyo, Tokyo, Japan).

J. Mater. Sci. (GB), vol.18, no.10, p.3023-30 (Oct. 1983).

The electrical behaviour of BCC $6Bi_2O_3.SiO_2$ sintered specimens was investigated by measuring electrical conductivity, ionic transference number, Seebeck coefficient and cationic composition. The total conductivity, σ_t, in the P_{02} range from 10^5 to 10^{-7} Pa showed mixed conduction where electron conductivity was predominant below 10^{-1} Pa and where σ_t could be expressed by the equation $\sigma_t=\sigma_i+\sigma_p{}^0.(Po_2/10^5\ \mathrm{Pa})^{1/4}+\sigma_n{}^0.(Po_2/10^5\ \mathrm{Pa})^{-1/4}$ where σ_i, $\sigma_p{}^0$ and $\sigma_n{}^0$ represent the oxygen ionic, hole and electron conductivities, respectively, at a Po_2 of 10^5 Pa. The silicon concentration in the specimen was slightly less than the theoretical value. The cation atomic ratio, Si/Bi (theoretically 1/12), was estimated as 0.93~0.95/12. Schottky-type defects of silcon and oxygen vacancies were proposed to explain a much higher oxygen ionic conductivity in the sintered specimens than that reported for single crystals. (19 refs.)

119670 Electrical conduction in β-Bi_2O_3 doped with Sb_2O_3. M.Miyayama, S.Katsuta, Y.Suenaga, H.Yanagida (Dept. of Industrial Chem., Univ. of Tokyo, Tokyo, Japan).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.585-8 (Aug. 1983).
Electrical conduction in tetragonal β-Bi_2O_3 doped with Sb_2O_3 was investigated by measuring electrical conductivity, ionic transference number, and Seebeck coefficient. The β-Bi_2O_3 doped with 1 to 10 mol.% Sb_2O_3 was stable up to 600°C and showed an oxygen ionic and electronic mixed conduction, where the electron conduction was predominant at low oxygen pressures. The oxygen-ion conductivity showed a maximum at 4 mol.% Sb_2O_3, whereas the activation energy for the ionic conduction remained unchanged for 4 to 10 mol.% Sb_2O_3-doped specimens. These results were interpreted in terms of the oxygen vacancy concentration and the distortion of the tetragonal structure. The electron conductivity and its oxygen pressure dependence decreased with increasing Sb_2O_3 content. The fact that Sb^{5+} is partially reduced by excess electrons in heavily doped β specimens at low oxygen pressures is explained. (21 refs.)

119671 Semiconductor to metal transition in $MoCl_5$ doped polyacetylene. M.Galtier, J.M.Gay, A.Montaner, J.L.Ribet (Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.107-10 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Conductivity, thermopower, infrared transmission measurements, performed on cis-CH_x doped with $MoCl_5$, exhibit clearly a semiconducting behaviour of concentration doping $Y<0.5\%$ and a metallic one for $Y>5\%$ but no sharp transition between them. (3 refs.)

119672 TCNQ simple salts of diquaternised 4,4′-bipyridyl. G.J.Ashwell (Dept. of Chem., Sheffield City Polytech., Sheffield, England), J.G.Allen.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1261-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The properties of 21 simple TCNQ salts of diquaternised 4,4′-bipyridyl are reported. The conductivities range from metallic to insulating with $\sigma(\mathrm{rt})=30$ to 10^{-10} S cm^{-1}. No correlation between the cation half-wave reduction potential and the electrical conductivity has been found. (10 refs.)

119673 On the electrical switching properties of polymeric liquid crystals. H.Pranoto, W.Haase (Inst. Physikalische Chem., Tech. Hochschule Darmstadt, Darmstadt, Germany).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.299-308 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The properties of side chain polymeric liquid crystals in an electric field are described. The polymers investigated are (A) a polysiloxan-copolymer with Cl- and OCH_3-end groups in the mesogenic side chains and (B) a polyacrylic ester homopolymer with a CN-group in the mesogenic side chain. Applying the Freedericksz-effect, the rise times and the passive decay times are determined. With the two-frequency technique, the active decay time is also obtained. The order of magnitude for the active decay time is about one second. The active decay time is approximately constant in a temperature region about 15K below the clearing point. (12 refs.)

119674 Origin of the low electronic component of the electrical conductivity of solid electrolytes based on β-Al_2O_3. B.Ya.Moizhes (All-Union Sci.-Res. Design-Construction Technol. Inst. of Current Sources, Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.532-3 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.924-6 (March 1983). [received: Oct. 1983]
The electronic component of the electrical conductivity of all the β-Al_2O_3 compositions is very low compared with the ionic component. Since the expected mobility of electrons (holes) is 1 $cm^2.V^{-1}.sec^{-1}$, i.e. it is 4-5 orders of magnitude higher than the measured mobility of the Na^+ ions, it follows that either the number of electrically active impurities is very low (10^{-6}-10^{-7} compared with the concentration of Na^+) or the impurity levels are very deep. The author considers both of these possibilities. (8 refs.)

Radical cation salts of arenes, synthesis, structures and properties .... See Entry 118995

Change of conduction mechanism with gamma dose of irradiated borosilicate glasses containing copper ions .... See Entry 119261

Erasable optical switching in semiconductor organic charge-transfer complexes .... See Entry 119445

Self-consistent scaling theory of the metal-insulator transition in disordered systems .... See Entry 119458

High pressure effects in MEM-$(TCNQ)_2$ .... See Entry 119575

Effect of illumination on current-voltage characteristics of $GdIn_3S_6$ single crystals .... See Entry 119659

XPS studies on thermal switching in thick film Al-VP glass-Al structure .... See Entry 119715

Electrical conductivity of doped polyacrylonitrile $(PAN)^+$ .... See Entry 119730

XPS spectra of BF_4^- doped polypyrrole in states of different conductivity .... See Entry 120218

72.70 NOISE PROCESSES AND PHENOMENA

119675 Noise in highly correlated commensurate charge transfer salts. H.Rommelmann (Xerox Webster Res, Center, Webster, NY, USA), J.W.Kaufer, A.J.Epstein, J.S.Miller.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1441-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors present the results of a study of the frequency (f) dependent noise power for commensurate charge transfer salts with strong Coulomb repulsion. f^{-1} noise is observed with increasing currents. Excess f^{-1} noise is measured for samples which were chemically doped to form solitons. Frequency independent shot noise is not observed. (10 refs.)

119676 Nonlinear AC dynamics and conduction noise in $NbSe_3$. N.P.Ong (Dept. of Phys., Univ. of Southern California, Los Angeles, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1659-63 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The phase-space plots (I vs. V) of $NbSe_3$ are obtained for driving frequencies ≈ 1 MHz. The strong hysteresis observed disagrees with the classical model. In a separate experiment on the noise spectrum shows the author that the CDW noise arises from the contact boundaries rather than from the bulk, and is unrelated to impurities or the pinning potential. (11 refs.)

119677 Theory of the narrow band noise spectrum and metastable conductivity due to sliding charge density waves. J.B.Sokoloff, B.Horovitz (Northeastern Univ., Boston, MA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1667-71 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors present molecular dynamical calculations on a model for sliding charge density waves interacting with impurities. Metastable electrical conduction is found as well as noise spectrum, which is studied as a function of system size. (9 refs.)

119678 The relaxation oscillator model for the narrow band noise in $NbSe_3$. M.Weger (Hebrew Univ., Jerusalem, Israel), W.G.Clark, G.Gruner.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1673-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The relaxation oscillator model for the narrow band noise in $NbSe_3$ is described. The frequency dependence of the signal and harmonics is found to confirm to this model. (10 refs.)

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72.80 CONDUCTIVITY OF SPECIFIC SEMICONDUCTORS AND INSULATORS

(see also 81.40R Electrical and magnetic properties related to materials treatment)

72.80C Elemental semiconductors

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Preparation and properties of sputtered a-Si:H:F films .... See Entry 119376

Amorphous silicon-phosphorus layer .... See Entry 119613

Influence of growth dislocations on low temperature conductivity in irradiated p-germanium .... See Entry 119616

Impact ionization of electrons in silicon (steady state) .... See Entry 119621

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Dependence of the ambipolar diffusion in silicon on the carrier density .... See Entry 119629

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Photoinduced absorption study of recombination in amorphous Si:H doped with P or B .... See Entry 119631

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Defect chemistry and intrinsic carrier concentration for $Hg_{1-x}Cd_xTe(s)$ for $x=0.20$, 0.40, and 1.0 .... See Entry 119635

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Anomalous photovoltaic effect in thin films of ZnSe obliquely deposited in vacuum .... See Entry 119652

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Minority carrier lifetime in LPE $Hg_{1-x}Cd_xTe$ ..... See Entry 119724

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72.80N Amorphous and glassy semiconductors

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Preparation and properties of sputtered a-Si:H:F films ..... See Entry 119376

Electrically conductive polymer-polymer composites ..... See Entry 119604

Amorphous silicon-phosphorus layer ..... See Entry 119613

Photoinduced absorption study of recombination in amorphous Si:H doped with P or B ..... See Entry 119631

Study of space charge effects on photoconduction in amorphous $Se_{0.95}Te_{0.05}$ films using a three electrode system ..... See Entry 119647

Spectroscopic analysis of transient photocurrents in a-As_2Se_3 ..... See Entry 119651

Wide optical gap, undoped, photoconductive a-Si_xN_{1-x}:H prepared by DC sputtering ..... See Entry 119662

Transparent conducting zinc oxide and indium-tin oxide films prepared by modified reactive planar magnetron sputtering ..... See Entry 120246

73.00 ELECTRONIC STRUCTURE AND ELECTRICAL PROPERTIES OF SURFACES, INTERFACES, AND THIN FILMS

73.20 ELECTRONIC SURFACE STATES

(for emission and impact phenomena, see 79.)

119679 A study of valence band shake-up features of CO on Pt{100} using synchrotron radiation. D.E.Grider, K.G.Purcell, N.V.Richardson (Donnan Labs., Univ. of Liverpool, Liverpool, England).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.320-4 (16 Sept. 1983).
A study of the shake-up features in the valence region of CO on Pt{100} is presented. The onset of these features is shown to be correlated with the excitation threshold for the Pt(4f) levels. A possible mechanism for the shake-up process is proposed in which the Pt(4f) hole results in excited states other than a single electron-hole state. Subsequently, the Pt(4f) hole decays via a direct recombination process resulting in the observed satellite features. The implications of such a shake-up process for photon-stimulated desorption (PSD) are also discussed. (18 refs.)

119680 Effects of vacuum annealing on the electronic properties of cleaved GaAs. F.Proix, A.Akremi, Z.T.Zhong (Lab. de Phys. des Solides, Univ. Pierre et Marie Curie, Paris, France).
J. Phys. C (GB), vol.16, no.28, p.5449-63 (10 Oct. 1983).
Low-energy electron diffraction, Auger electron spectroscopy and photoemission yield spectroscopy measurements have been performed on GaAs samples cleaved in ultra-high vacuum and subject to in situ isochronous anneals up to 850°C. The properties of the cleaved (110) surface remain unchanged up to about 350°C. Around this temperature, a dissociation occurs inducing a local reconstruction of the surface; at the same time, new states appear which may be attributed to Ga vacancies. Then, around 580°C, the well known dissociation of GaAs sets in with formation of As_2, and the Ga-Ga bonds which then form, determine the electronic properties of the sample. Evaporation of arsenic would become dominant around 650°C. Beyond about 780°C, the excess Ga coalesces into Ga-metal droplets and the GaAs substrate undergoes faceting. (33 refs.)

119681 Surface photovoltage spectroscopy and thermally stimulated contact potential difference studies of real ZnS surfaces. M.S.El-Dessouki, V.A.Attia (Dept. of Phys., Cairo Univ., Giza, Egypt).
J. Phys. & Chem. Solids (GB), vol.44, no.10, p.939-42 (1983).
Surface photovoltage spectroscopy and thermally simulated contact potential difference measurements are reported for real ZnS surfaces. The measurements allow the determination of the surface states existing via two different processes, i.e. optical excitation of carriers into and from the existing surface states. Changing the surface condition by annealing at 350°C produces different electronic features which are attributed to different bondings at surface vacancy sites. Furthermore, annealing changes the polarity of the surface photovoltage. (34 refs.)

119682 Convergence study of the density-gradient expansion for the screened-Coulomb exchange energy. A.-R.E.Mohammed (Dept. of Phys., Brooklyn Coll. of the City Univ. of New York, New York, NY, USA), V.Sahni.
Phys. Rev. B (USA), vol.28, no.6, p.3014-21 (15 Sept. 1983).
In this work the authors have studied the convergence properties of the density-gradient expansion for the exchange energy for screened-Coulomb interaction as applied to surfaces. The expansion examined is that which is valid within the Hartree-Fock approximation, and the densities for which the convergence is tested are those derived from the step-potential model of a surface. Surprisingly, contrary to intuitive expectations for a short-range interaction, it is observed that both the gradient expansion as well as the local-density approximations are poor. Furthermore, the former approximation does not reduce the error of the latter to any significant degree even for the most slowly varying of the densities considered. The results of calculations for the gradient expansion for the bare-Coulomb exchange energy, together with consideration of various convergence conditions, indicate that this lack of convergence is principally due to the limitations of the step-potential model. The arguments and different conclusions arrived at in previous work on this expansion by others using the step-potential model are also examined, and suggestions for future work made. (42 refs.)

119683 Electronic structure of metal overlayers on rhodium. P.J.Feibelman (Sandia Nat. Labs., Albuquerque, NM, USA), D.R.Hamann.
Phys. Rev. B (USA), vol.28, no.6, p.3092-99 (15 Sept. 1983).
The authors have evaluated work functions, surface core-level shifts, and surface band dispersions for clean, Ag-covered, and Pd-covered Rh(100) surfaces, and for clean and Ag-covered Rh(111). The calculations were performed self-consistently, using the surface-linearized augmented-plane-wave method. As expected from the Pauling electronegativities, Ag adsorption lowers the work function from the clean Rh value, by several tenths of an eV, while Pd has an almost negligible effect. The values calculated for the core-level shifts of various films are shown to correspond to expectations based on surface band narrowing and layerwise charge neutrality. Using the core-level shifts, they predict heat-of-adsorption differences (for Ag on Pd vs. Ag on Rh, etc.) that are in quite good agreement with the empirical predictions of Miedema and Dorleijn. Finally, the chemical inactivity of the Ag-covered Rh surface is associated with the fact that, for that system, the outer-layer local density of states is essentially that of Ag, with a characteristically low value at the Fermi energy. On the other hand, the Pd-covered Rh surface is associated with the fact that, for that system, the outer-layer local density of states is essentially that of Ag, with a characteristically low value at the Fermi energy. On the other hand, the Pd-covered Rh surface should behave much like clean Rh with an extra electron per surface atom. The surface band dispersions for the Pd-covered and clean Rh surfaces are closely similar. This result contrasts sharply with the case of Pd-covered Nb, for which, because of the appreciable electronegativity difference, the Pd overlayer is effectively 'noble'. (28 refs.)

119684 Electronic structure of transition-metal—transition-metal interfaces: Pd on Nb(110). V.Kumar, K.H.Bennemann (Inst. fur Theoretische Phys., Freie Univ. Berlin, Berlin, Germany).
Phys. Rev. B (USA), vol.28, no.6, p.3138-49 (15 Sept. 1983).
With the use of a self-consistent tight-binding scheme, local electronic densities of states (LDOS) are calculated for commensurate (*C*) Pd* (110) and incommensurate (*IC*) Pd (111) layers on Nb (110). At low coverages ($\Theta<1$) Pd induces a Pd-Nb resonance near the bottom of the Nb *d* band. In agreement with the experimental results this resonance shifts to lower binding energy as the coverage is increased. Comparing detailed features of the

LDOS with the photoemission data the authors predict a *C-IC* structural transformation for approximately one monolayer of Pd. This they also conclude from a simple interface energy calculation. The *d*-electron charge transfer across the interface and the LDOS of Pd at the Fermi energy (E_F) are small. The latter, however, increases with the Pd coverage. The LDOS of the top Pd layer is nearly the same for Pd (111) on Pd* (110)-Nb (110) or Pd (111)-Nb (110) interfaces and in all cases there is a significant decrease of Nb *d* states near the E_F. This shows that the LDOS is mainly perturbed at the interface. Implications of these results for hydrogen uptake and work-function changes are discussed. (52 refs.)

119685 Interaction of CO and N_2 with the Cu (111) surface. W.Eberhardt (Corporate Res. Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA), E.W.Plummer.
Phys. Rev. B (USA), vol.28, no.6, p.3605-7 (15 Sept. 1983).
The electronic structure of the Cu (111) surface changes upon adsorption of CO or N_2. Comparing the results for both adsorbates, the authors are able to differentiate between changes in the electronic structure induced by a change in the potential at the surface or by a chemical bond. The Λ_1 surface state is involved in the chemical bond of CO. On the other hand, a surface resonance at the top of the *d* bands and an absorbate-induced surface state at the bottom of the *d* bands are caused by changes in the potential. (12 refs.)

119686 Generalized topological transition; the surface phase transition of order $2^1/_2$. M.I.Kaganov, A.A.Nurmagambetov (Inst. of Phys. Problems, Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.6, p.1331-3 (Dec. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.6, p.2296-300 (Dec. 1982). [received: Oct. 1983]
It is shown that a change in the local structure of the Fermi surface can lead to a singularity of the electronic part of the surface energy of a conductor. At zero temperature this singularity should be treated as a phase transition of order $2^1/_2$. (10 refs.)

Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride .... See Entry 116917

Degenerate four wave mixing with long range surface plasmons in attenuated total reflection geometries .... See Entry 118210

A cluster model method and its applications to chemisorptions on semiconductor surfaces .... See Entry 119333

All-electron local-density theory of alkali-metal bonding on transition-metal surfaces: Cs on W(001) .... See Entry 119345

Band gap variation and lattice, surface, and interface 'instabilities' in $Hg_{1-x}Cd_xTe$ and related compounds .... See Entry 119428

Effects of gaps on long range surface plasmon polaritons .... See Entry 119468

Virtual surface plasmons in cylinders .... See Entry 119491

Mobility of carriers in inversion layers in semiconductors .... See Entry 119619

Techniques for improving the Si-SiO_2 interface characterization .... See Entry 119708

Energy concepts of insulator-semiconductor interface traps .... See Entry 119711

Low-energy electron energy-loss spectra associated with reconstructed structure on Si (111) surface .... See Entry 120198

Core-level photoelectron spectroscopy of surfaces and adsorbates .... See Entry 120215

Cooper-minimum effects in the photoionization cross sections of *4d* and *5d* electrons in solid compounds .... See Entry 120219

Characterization of thin Nb_3Sn diffusion layers on Nb (110): low-energy electron-diffraction and photoemission studies .... See Entry 120220

Initial stages of oxide formation on HgCdTe exposed to activated oxygen .... See Entry 120464

73.25 SURFACE CONDUCTIVITY

Intrinsic defects of TiO_2 (110): Interaction with chemisorbed O_2, H_2, CO, and CO_2 .... See Entry 119347

73.30 SURFACE DOUBLE LAYERS, SCHOTTKY BARRIERS, AND WORK FUNCTIONS

119687 Schottky barrier height of Au/p-$In_{1-x}Ga_xAs_yP_{1-y}$ with native oxide. M.Naitoh, S.Sakai, M.Umeno (Dept. of Engng. Sci., Nagoya Inst. of Technol., Nagoya, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1224 (July 1983).
The Schottky barrier height depends strongly on the surface treatment before vacuum evaporation. The current-voltage relations of Au/p-InGaAsP diodes obtained by etching in Br+CH_3OH and stopping with CH_3OH and etching in Br+CH_3OH and stopping with water, for about 1 min at room temperature, are shown. The Schottky barrier height of Au/p-InGaAsP diodes decreases linearly with increasing As composition *y*. This linear relationship implies that the Schottky barrier height of the semiconductor with native oxide, as well as that with the atomically clean surface obeys the common anion rule. (8 refs.)

119688 A study of Schottky contacts on indium phosphide. E.Hokelek, G.Y.Robinson (Dept. of Electrical Engng., Univ. of Minnesota, Minneapolis, MN, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5199-205 (Sept. 1983).
The Schottky-barrier energy ϕ_B for Al, Ni, Pd, Co, Au and Ag contacts on chemically etched ⟨100⟩ surfaces of both *p*- and *n*-type InP was measured and the metallurgical behavior of the contact structures was studied using Auger-electron spectroscopy. No simple linear relationship could be found between the measured Schottky barrier energies on InP and the work functions or the electronegativities of the contact metals. Therefore, the results could not be explained in terms of the traditional Schottky and Bardeen theories. However, a very well defined relationship was observed between the Schottky barrier energies and the heats of reaction per formula unit ΔH_r for the most stable metal phosphides that could be formed between the contact metals and the InP substrate. The contact metals Au and Ag whose phosphides are less stable than InP (i.e., $\Delta H_r > 0$) produced diffuse interfaces, characterized by extensive outdiffusion of In, and yielded low values of ϕ_{Bp}, the Schottky-barrier energy on *p*-type InP; whereas the contact metals Al and Ni which can form compounds with phosphorus that are significantly more stable than InP (i.e., $\Delta H_r < 0$) showed less In outdiffusion and produced higher values of ϕ_{Bp}. Two distinct Fermi-level pinning positions located at 0.50 ± 0.01 eV and 0.40 ± 0.02 eV below the conduction band minimum of InP were found and correlated to the metallurgical state of the contact structures. The findings of the present study strongly suggest that Schottky-barrier formation on InP is controlled by chemical reaction between the contact metal and the InP substrate with the degree of chemical reactivity appearing to determine the Fermi-level pinning position at the interface. (51 refs.)

Alkali metal-induced reconstruction of Ag(110) .... See Entry 119322

All-electron local-density theory of alkali-metal bonding on transition-metal surfaces: Cs on W(001) .... See Entry 119345

Intrinsic defects of TiO_2 (110): Interaction with chemisorbed O_2, H_2, CO, and CO_2 .... See Entry 119347

Energy band structure and electronic transport properties of niobium monoxide .... See Entry 119429

Photovoltaic behaviour of rhodamine 6G Schottky-type cells .... See Entry 119660

Trap-assisted tunneling in MIS and Schottky structures .... See Entry 119713

Investigation of the electronic band structure of gold by means of spin-polarized photoelectrons .... See Entry 120221

Review of conductor-polymeric semiconductor solar cells .... See Entry 120738

73.40 INTERFACES

Surface photovoltage spectroscopy and thermally stimulated contact potential difference studies of real ZnS surfaces .... See Entry 119681

73.40B Static electrification

119689 Investigation of the electrostatic charging of dispersed thermoplastics in fluidized systems. V.A.Dovgyalo, O.R.Yurkevich (Inst. of the Mech. of Metal-Polymer Systems, Acad. of Sci., Gomel, Belorussian SSR).
Colloid J. USSR (USA), vol.44, no.6, p.913-16 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1034-8 (Nov.-Dec. 1982). [received: Sept. 1983]
The features of the charging of dispersed thermoplastic polymers and two-component composites based on them due to static electrification as a result of contact interactions in fluidized systems have been investigated. The influence of the technological conditions, the dielectric properties of the polymers, and the nature and content of modifiers on the charge of the static electricity and the distribution of the particles with respect to the sign of the charge upon fluidization has been demonstrated. (6 refs.)

119690 Linear flexible-chain polymer electrification conditions and pattern at $T > T_G$. V.E.Dreval, V.P.Protasov, G.V.Vinogradov (Inst. of Petrochem. Synthesis, Acad. of Sci., Moscow, USSR).
Polym. Bull. (Germany), vol.10, no.7-8, p.343-50 (Sept. 1983).
A study has been made concerning the static electrification of such linear flexible-chain polymers as polybutadiene, polyisoprene, and fluorine rubber with wide and narrow molecular-weight distributions at $T > T_g$. It has been found that static electrification occurs as a result of a relaxation transition of polymers from the fluid to high-elastic state, accompanied by breakdown of the specimens and their detachment from the walls confining the flow, which leads to slip-page of the polymers. This phenomenon is explained in terms of the activation theory of polymer friction. The dependence of static electrification on temperature, molecular weight, and molecular-weight distribution is determined by the effect of these parameters on the relaxation characteristics of a polymer, and, more particularly, its segmental mobility. (11 refs.)

Effect of gas on the electret charge reduction by radiation .... See Entry 119972

73.40G Tunnelling: general

(see also 74.50 in superconductors)

Theory of the passage of particles and waves through randomly inhomogeneous media .... See Entry 117129

73.40L Semiconductor-to-semiconductor contacts, p-n junctions, and heterojunctions

119691 Resonant tunneling through quantum wells at frequencies up to 2.5 THz. T.C.L.G.Sollner, W.D.Goodhue, P.E.Tannenwald, C.D.Parker, D.D.Peck (Lincoln Lab., MIT, Lexington, MA, USA).
Appl. Phys. Lett. (USA), vol.43, no.6, p.588-90 (15 Sept. 1983).
Resonant tunneling through a single quantum well of GaAs has been observed. The current singularity and negative resistance region are dramatically improved over previous results, and detecting and mixing have been carried out at frequencies as high as 2.5 THz. Resonant tunneling features are visible in the conductance-voltage curve at room temperature and become quite pronounced in the *I-V* curves at low temperature. The high-frequency results, measured with far IR lasers, prove that the charge transport is faster than about 10^{-13} s. It may now be possible to construct practical nonlinear devices using quantum wells at millimeter and submillimeter wavelengths. (8 refs.)

119692 Epitaxial Si layer of Si-BP-Si structure. S.Sugiura, T.Yoshida, K.Shono (Faculty of Sci. & Technol., Sophia Univ., Tokyo, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L426-8 (July 1983).
Boron monophosphide (BP) was epitaxially grown on an Si substrate and Si was also grown on the BP. On the Si epitaxial layer, PMOS transistors and inverter and flip-flop circuits were fabricated. The CV curve measured at 1 MHz gave a donor concentration near the surface of 2×10^{16} cm^{-3}. The PMOS transistors gave a threshold voltage of -2.6 ± 0.6 V and a surface hole mobility of 230 ± 30 $cm^2/V.s.$ for SiO_2 at a thickness of 0.1 μm. (6 refs.)

119693 HgCdTe heterojunctions. P.R.Bratt (Santa Barbara Res. Center, Goleta, CA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1687-91 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
HgCdTe heterojunctions consisting of a wide band gap *n*-type $Hg_{1-x}Cd_xTe$ layer grown epitaxially on a narrow band gap *p*-type $Hg_{1-y}Cd_yTe$ substrate ($x > y$) were studied. The heterojunction transition region between *x* and *y* materials was found to be graded over distances of about 0.4 to 0.8 μm. The position of the *p-n* junction depletion layer within the graded transition region was the major factor controlling the heterojunction properties. When the depletion layer was located near the narrow band gap material, normal photodiode behavior was observed. When the depletion layer was at the center of the transition region or near the wide band gap material, a potential barrier was formed which inhibited minority carrier photocurrent originating in the *p*-type material from crossing the heterojunction. Qualitative energy band models based on the analysis of HgCdTe heterojunctions recently published

by Migliorato and White (1983) were constructed to explain the observed results. (10 refs.)

119694 On the determination of the energy band offsets in $Hg_{1-x}Cd_xTe$ heterojunctions. T.N.Casselman (Santa Barbara Res. Center, Goleta, CA, USA), A.Sher, J.Silberman, W.E.Spicer, A.B.Chen.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1692-5 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
The energy band offsets play a critical role in the electrical properties of heterojunctions. The authors raise here serious questions regarding the precision and accuracy of the measured and calculated energy band offsets in HgCdTe heterostructures. They argue that the Anderson model prescription for the offsets is not useful and is not correct for abrupt heterojunctions when narrow band gap semiconductors are the constituents of the heterostructure. New values for the photoionization energy of $Hg_{1-x}Cd_xTe$ are given and the reliability of these values for determining the offset is discussed. (13 refs.)

119695 Multibarrier tunneling in $Ga_{1-x}Al_xAs$/GaAs heterostructures. M.O.Vassell, J.Lee, H.F.Lockwood (GTE Labs. Inc., Waltham, MA, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5206-13 (Sept. 1983).
A theoretical study of resonant tunneling in multilayered $Ga_{1-x}Al_xAs$/GaAs structures is presented. The spectrum of resonant energies and its dependence on the barrier structure are analyzed from calculated profiles of barrier transparency versus energy, and from current-voltage characteristics computed at selected temperatures and Fermi levels. The present formalism is based on the effective mass approximation as done to date, but contains three significant improvements: a more realistic treatment of the spatial dependence of effective masses and band edges; the recognition of the special dynamical role played by the transverse energy as a consequence of the difference in itinerant two dimensional carrier motion from layer to layer; and the avoidance of plane-wave or WKB approximations for calculating the wave function in favor of direct numerical evaluation. It is shown that these revisions lead to quantitative differences with results of previous work. (17 refs.)

119696 Persistent photoconductivity in (Al,Ga)As/GaAs modulation doped structures: dependence on structure and growth temperature. J.Klem, W.T.Masselink, D.Arnold, R.Fischer, T.J.Drummond, H.Morkoc (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA), K.Lee, M.S.Shur.
J. Appl. Phys. (USA), vol.54, no.9, p.5214-17 (Sept. 1983).
When modulation doped (Al,Ga)As/GaAs heterostructures are exposed to light, the interface electron concentration and in most cases the mobility increases substantially for lattice temperatures below ~100K. A substantial part of the increase is persistent and attributed to the excitation of electrons from a donor-vacancy complex in the (Al,Ga)As. The change in the free electron concentration in the (Al,Ga)As is calculated using a recently developed model for electron transfer across a modulation doped heterojunction. The persistent increase in the free electron concentration is used as a measure of the trap concentration. The magnitude of the photoconductivity response decreased with increasing growth temperature in the range 580-750°C. The dependence on Al mole fraction was studied for $0.16 \leq x \leq 1.0$ and found to be a maximum for $x \sim 0.3$. (25 refs.)

119697 A new space-charge-limited-current diode theory with analysis of Cu_xS/CdS data. L.D.Partain (Chevron Res. Co., Richmond, CA, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5218-26 (Sept. 1983).
A new theory for trap controlled, space-charge-limited-current (SCLI) diode behavior has been derived. Standard approaches have been modified so that only the drift component of current transport is considered along with the asymmetric boundary conditions required for rectification. Simple analytical expressions for the current-voltage properties were obtained for the single-trapping level case. A straightforward, numerical integration scheme was developed for the multiple trapping level situation. Application of the results to Cu_xS/CdS current-voltage data provides the first SCLI explanation for rectification in these devices. Electron trapping levels at 0.60, 0.44 and 0.20 eV below the conduction band edge with respective concentrations of $3(10^{15})$, $6(10^{14})$, and $3.1(10^{17})$ cm^{-3} were identified. These parameters compare well to electron traps reported in the literature for Cu_xS/CdS and gold/CdS diodes measured by deep-level-transient spectroscopy (DLTS), admittance spectroscopy, and by SCLI analysis. (38 refs.)

119698 Theory of the magnetophonon effect for the two-dimensional electron gas in semiconducting heterostructures. R.Lassnig (Inst. of Experimental Phys., Univ. of Innsbruck, Innsbruck, Austria), W.Zawadzki.
J. Phys. C (GB), vol.16, no.28, p.5435-40 (10 Oct. 1983).
The theory of the transverse magnetophonon effect is developed for inversion layers in semiconducting heterostructures in the presence of a quantising magnetic field perpendicular to the interface. It is assumed that the electrons move in quasi-two-dimensional sub-bands, and that the optic phonons and the polar electron-phonon interaction are not modified by the presence of the interface. Collisional broadening of the Landau levels is taken into account. The theoretical results show a good agreement with the experimental results for the magnetophonon effect in GaAs/AlGaAs heterostructures. (11 refs.)

119699 Two-dimensional magneto-quantum transport on GaAs-$Al_xGa_{1-x}As$ heterostructures under non-ohmic conditions. G.Eber, K.von Klitzing (Phys.-Dept., Tech. Univ., Munchen, Garching, Germany), K.Ploog, G.Weinmann.
J. Phys. C (GB), vol.16, no.28, p.5441-8 (10 Oct. 1983).
Measurements of the conductivity σ_{xx} in the minima of the Shubnikov-de Haas oscillations on GaAs-$Al_xGa_{1-x}As$ heterostructures show that at helium temperatures a strong non-ohmic behaviour is observed with an instability in the current-voltage characteristic at electric field values of about 100 V cm^{-1} at B=7T. The data are analysed on the basis of an electric-field-dependent electron temperature. (15 refs.)

119700 Deep centers in semiconductor devices: mean lifetime control. J.Barbolla, L.A.Bailon.
Mundo Electron. (Spain), no.132, p.87-92 (Oct. 1983). In Spanish.
The authors discuss the most frequent processes of emission and capture of carriers by a deep center in a semiconductor. The study is centered on thermal emission and capture. The mean lifetime of the free carriers in a semiconductor, controlled by the presence of a bipolar deep center, is defined and calculated. Also calculated is the reverse current of a junction due to the thermal generation of the carriers by a polar deep center in the space-charge region of the junction. The conditions that a deep center should fulfil, so that the mean lifetime of free carriers in a semiconductor is as short as possible while the reverse current of a junction due to the thermal generation of the carriers is as small as possible, are studied. (7 refs.)

119701 Electrical properties of junctions between sputter deposited silicon films and monocrystalline silicon. J.Koshy (Dept. of Phys., Federal Univ. of Technol., Bauchi, Nigeria).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K21-4 (Sept. 1983).
The author discusses the properties of junctions formed by sputter deposited a-Si films onto chemically etched n and p-Si crystals. I-U and C-U measurements on the junctions were used to calculate the barrier height and the density of states at the Fermi level of sputter deposited a-Si films for the first time. (10 refs.)

119702 Variational calculations on a quantum well in an electric field. G.Bastard, E.E.Mendez, L.L.Chang, L.Esaki (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3241-5 (15 Sept. 1983).
The authors present variational calculations of the eigenstates in an isolated-quantum-well structure subjected to an external electric field. At weak fields a quadratic Stark shift is found whose magnitude depends strongly on the finite well depth. In addition, the electric field induces a spatial shift of the particle wave function along or opposite to the field direction, depending on the sign of the particle mass. This field-induced spatial separation of conduction and valence electrons in GaAs quantum wells decreases the overlap between their associated wave functions, leading to a reduction of interband recombination. (15 refs.)

119703 Subbands in back-gated heterojunctions. B.Vinter (Div. Composants Microonde, Thomson-CSF, Orsay, France).
Solid State Commun. (USA), vol.48, no.2, p.151-4 (Oct. 1983).
The subband structure at low temperature of an $Al_xGa_{1-x}As$/GaAs heterojunction in which the density is modulated by a gate on the GaAs substrate has been calculated with full account of tunnelling between the two sides of the junction. The results show that when the first excited subband is occupied, the number of electrons in the lowest subband remains essentially constant independent of back-gate voltage, in agreement with a recent experiment. Comparison of the calculated density at which the first excited subband starts being occupied with the experiment indicates that the doping impurities behave quite differently in AlGaAs than in GaAs, even for an Al concentration of 0.22. (16 refs.)

Two-dimensional quantum-mechanical confinement of electrons in DH lasers by strong magnetic fields ....See Entry 118143

Determination of p-n junctions in InP/GaInAsP laser heterostructures using a profilometer ....See Entry 118146

Ion dechanneling due to lattice strains in semiconductor superlattices ....See Entry 119077

Silicon-gallium-phosphide heterostructures with a $(Si_2)_x(GaP)_{1-x}$ transition region ....See Entry 119357

Metal-organic vapor deposition of CdTe and HgCdTe films . See Entry 119361

The preparation and characterization of strained-layer superlattices in the GaAs+GaP system ....See Entry 119365

Quantization of the Hall conductance in a two-dimensional electron gas ....See Entry 119637

The physics and applications of the two-dimensional electron gas ....See Entry 119707

Recent progress on LADA growth of HgCdTe and CdTe epitaxial layers ....See Entry 120244

Latest developments in the growth of $Cd_xHg_{1-x}Te$ and CdTe-HgTe superlattices by molecular beam epitaxy ....See Entry 120251

Review of conductor-polymeric semiconductor solar cells ......See Entry 120738

73.40M Semiconductor-electrolyte contacts

119704 Polypyrrole electrodes, charge transfer to aqueous and solid polymer electrolytes. T.A.Skotheim (Dept. of Energy & Environment, Brookhaven Nat. Lab., Upton, NY, USA), S.W.Feldberg, M.B.Armand.
J. Phys. Colloq. (France), vol.44, no.C-3, p.615-20 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors have studied interfaces between conducting polypyrrole and aqueous and solid polymer electrolytes. Polypyrrole is porous to solvent and electrolyte ions but not to solid polymer electrolytes. Contrasting the two interfaces shows unambiguously that the porosity, and consequently large actual surface area, is responsible for the observed rapid rate of charge transfer to ionic species in solution. (13 refs.)

119705 Influence of hydrogen reduction on photoelectrochemical behavior of anodic oxidized n-TiO_2-layers. K.J.Hartig, N.Getoff (Inst. fur Theoretische Chem. und Strahlenchem., Univ. Wien, Wien, Austria), K.D.Kotchev, St.Kanev.
Sol. Energy Mater. (Netherlands), vol.9, no.2, p.167-76 (July-Sept. 1983).
The behavior of polycrystalline n-TiO_2-photoanodes produced by anodic oxidation of Ti-metal foils and subsequently reduced in hydrogen atmosphere at various temperatures and different times was investigated. The employed methods for their characterization were: scanning electron microscopy, X-ray diffraction, thickness determination, open-circuit voltage and capacitance/voltage studies as well as photoelectrochemical measurements. The reduction process results in an increase of oxygen deficiencies and a decrease of the amount of recombination centers and of grain boundary energy barriers between the crystallites. All these parameters lead to a significant increase of the photoefficiency. The best photoanodes were obtained, when the anodically oxidized samples were reduced under hydrogen at 800-850°C for 15 min (conversion of anatase to rutile crystal structures). (17 refs.)

73.40N Metal-nonmetal contacts

Interaction of thin layers of Al and Ge with cleaved (Hg,Cd)Te surfaces ....See Entry 119279

Auger spectroscopy of metal-semiconductor interface in the In-$Pb_{1-x}Sn_xTe$ system ....See Entry 119354

The role of polaritons in superconductivity phenomenon [metal-dielectric contacts] ....See Entry 119467

Schottky barrier height of Au/p-$In_{1-x}Ga_xAs_yP_{1-y}$ with native oxide ....See Entry 119687

A study of Schottky contacts on indium phosphide ....See Entry 119688

Study of cleaved, oxidized, and heat-treated CdTe surfaces ...See Entry 120461

73.40Q Metal-insulator-semiconductor structures

(inc. semiconductor-to-insulator)

119706 Gold diffusion through silicon dioxide. G.R.Moghal (Appl. Phys. & Instrumentation Technol. Div., PCSIR Labs., Karachi, Pakistan).
Mehran Univ. Res. J. Eng. & Technol. (Pakistan), vol.2, no.2, p.1-4 (April 1983). [received: Oct. 1983]
Gold introduces positive surface charge at the silicon/silicon dioxide interface when diffused from the front side of the silicon device. This leads to a shift of MOS device characteristics towards negative gate biases. It is also found that the positive surface charge due to gold in the oxide is independent of temperature. (7 refs.)

119707 The physics and applications of the two-dimensional electron gas. M.J.Kelly.
GEC J. Res. Incorp. Marconi Rev. (GB), vol.1, no.1, p.15-23 (1983).
The confinement of electrons to within 10-20 nm of the Si/SiO_2 or $GaAs/Ga_{1-x}Al_xAs$ interface provides not only the heart of modern microelectronics, but also a particulary fertile and flexible system for the study of basic physics. Tools developed over many decades in metal physics have all been applied to this two-dimensional metallic system within the last decade, providing ideas for ultra-fast device structures and elucidating quantum processes in electronic transport, in which respect, the quantum Hall effect, a new resistance standard, has been a crowning achievement. (43 refs.)

119708 Techniques for improving the Si-SiO_2 interface characterization. A.Sher (SRI Internat., Menlo Park, CA, USA), H.J.Hoffman, Pin Su, Y.H.Tsuo.
J. Appl. Phys. (USA), vol.54, no.9, p.5183-98 (Sept. 1983).
In a companion paper [P. Su, A. Sher, Y.H. Tsuo, J.A. Moriarty, and W.E. Miller, Appl. Phys. Lett. 36, 991 (1980)], an improved characterization of the Si-SiO_2 interface in metal-insulator-semiconductor-capacitor (MIS-C) structures was reported. In this paper, details of the refined experimental methods that lead to those results are presented, and a more extensive interpretation offered. The well-established quasistatic and conductance methods are improved by using (i) effectively thin composite insulators, (ii) low carrier concentration substrates, and most importantly (iii) low-level illumination at a wavelength that creates electron-hole pairs. Items (i) and (ii) extend the dynamic range of the interface-state density measurement to four decades. Item (iii) decreases the response time of the slow states (for *n*-type samples, those in the lower part of the band gap); thus, the quasistatic condition is well satisfied and the conductance method can be used on all the states throughout the band gap. Without illumination, the quasistatic condition is not satisfied, even for ramp rates on the low side of those used previously. The major consequences of not satisfying the quasistatic condition are that the deduced variation in surface potential is too large, the interface-state density is underestimated, and the positive-fixed-charge density is overestimated. The sample investigated had a 250-Å, thermally grown oxide prepared in dry oxygen. It was never exposed to H_2 or H_2O at an elevated temperature. The authors spectulate that this processing produces an abrupt Si-SiO_2 interface. The composite gate insulator was completed by having an *e*-gun deposited 250 Å of LaF_3. The resulting interface, subjected to the improved experimental method, yields a wealth of distinctive structure rather than the often-reported featureless U-shaped interface-state density. (37 refs.)

119709 A new transient capacitance technique for the determination of interface traps in metal-oxide semiconductor transistors. P.Vitanov (Inst. of Microelectronics, Sofia, Bulgaria), I.Eisele.
J. Appl. Phys. (USA), vol.54, no.9, p.5227-30 (Sept. 1983).
A new method for determining the interface trap distribution is described. The measurements are performed on *n*-channel metal-oxide-semiconductor field-effect transistors and yield the densities of interface traps near the minority carrier band $(0.04<E_t-E_c<0.3)$. The technique reveals trap densities as low as 2×10^8 cm^{-2} eV^{-1}. The sensitivity is high enough to still detect capacitance changes of the order of 0.01 pF out of the noise. The method is applicable to samples with nonuniform doping concentrations. (12 refs.)

119710 Electric field induced effects at the Si-SiO_2 interface: theory and experiment. M.G.Ancona (Naval Res. Lab., Washington, DC, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5231-9 (Sept. 1983).
In a previous paper the fully macroscopic description of semiconductors was employed to demonstrate on theoretical grounds that the surface charge density at a semiconductor interface, as measured statically, depends not only on surface potential but also on surface electric field. In the present work, further theoretical discussion of this effect is given and, most importantly, experimental evidence demonstrating its existence and significance at Si-SiO_2 interfaces is obtained. In particular, it appears necessary to describe certain features of the admittance of a metal-oxide-semiconductor capacitor in inversion not explained by conventional theory. The coefficient quantifying these electric field effects, which is determined for particular samples, represents an additional independent parameter by which interfaces may be characterized. The importance of the effect in the interface description leads to a clearer macroscopic understanding of the meaning of the 'interface state density' (D_{it}) which is commonly determined from macroscopic (electrical) experiments. And, in connection with the underlying microscopic picture, its significance may provide experimental support for the microscopic bond strain model for the origin of interface states. (20 refs.)

119711 Energy concepts of insulator-semiconductor interface traps. O.Engstrom (Nat. Defence Res. Inst., Linkoping, Sweden), A.Alm.
J. Appl. Phys. (USA), vol.54, no.9, p.5240-4 (Sept. 1983).
A general statistical language developed for impurities and defects in semiconductors has been applied to the interpretation of experimental results from different methods of investigations of insulator-semiconductor interface traps. Interface state energy distributions obtained from traditional capacitance-voltage methods or 'scanned light pulse technique' are interpreted in a Gibbs free energy scale. On the other hand, distributions obtained from deep level transient spectroscopy (DLTS) are put on an enthalpy scale. The difference between the two parameters depends on the entropy properties of the trap centers. Carrier capture data taken from DLTS are demonstrated to be influenced by the 'entropy factor' of the interface trap resulting in discrepancies of capture cross sections of up to two orders of magnitude. It is further pointed out that the energy resolution of experimental energy state distributions is fairly rough for different methods ranging up to 0.1 eV for the *CV* technique at room temperature. (20 refs.)

119712 Scanned light pulse technique for the investigation of insulator-semiconductor interfaces. O.Engstrom, A.Carlsson (Nat. Defence Res. Inst., Linkoping, Sweden).
J. Appl. Phys. (USA), vol.54, no.9, p.5245-51 (Sept. 1983).
A new measurement method, scanned light pulse technique, for the investigation of the interface properties of metal-insulator-semiconductor (MIS) structures is introduced. The measured signal is the charge contents of current transients induced by light pulses applied to the investigated sample. This signal depends on surface potential, interface state density and voltage applied to the MIS structure. By analyzing the results of such measurements it is quantitatively demonstrated how insulator charge and interface state distribution influence the voltage dependence. By scanning a light spot across the surface of an MIS structure with transparent metal electrode it is further shown that pictures of the spatial variation of the surface potential and the interface state density can be obtained. (18 refs.)

119713 Trap-assisted tunneling in MIS and Schottky structures. F.Capabadal, V.Milain, X.Aymerich-Humet (Dept. d'Electricitat i Electronica, Univ. Autonoma de Barcelona, Barcelona, Spain).
Phys. Status Solidi a (Germany), vol.79, no.1, p.223-36 (Sept. 1983).
Trap-assisted tunneling current in metal-insulator-semiconductor and metal-semiconductor (Schottky) structures with traps in the insulator and in the semiconductor, respectively, is obtained, using the stationary resonance model. The two-band model is considered for the insulator gap of the MIS structure, introducing an effective potential barrier. A comparison between resonant and direct tunneling currents in MIS structures is performed, showing that the main conduction mechanisms is determined by the trap density, the oxide thickness, and the trap depth. For the Schottky diodes, the resonant current-voltage characteristic is analysed as function of the centre of resonance of the system. A discussion between resonant tunneling in MIS and Schottky structures is also included. (25 refs.)

119714 Stress effects on the switching voltage of metal-SnO_2-Si(n)-Si(p^+) devices. H.K.Phan, L.H.Phu, C.V.Chiem (Inst. of Phys., Hanoi, Vietnam).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K25-8 (Sept. 1983).
The authors report a first experimental study of the stress effects on the current-voltage characteristics of metal-SnO_2-Si(n)-Si(p^+) devices. Among the observed effects the most noticeable one is the decrease of the switching voltage with increasing stress. This effect is reversible. (8 refs.)

Characterization of SOS films grown with amorphous Si buffer layers by MOS FETs .... See Entry 119722

Passivation properties and interfacial chemistry of photochemically deposited SiO_2 on $Hg_{0.70}Cd_{0.30}Te$ .... See Entry 120465

73.40S Metal-semiconductor-metal structures

119715 XPS studies on thermal switching in thick film Al-VP glass-Al structure. M.S.Setty, S.R.Sainkar, A.P.B.Sinha (Phys. Chem. Div., Nat. Chem. Lab., Poona, India).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L381-2 (July 1983).
Thick film sandwich structures of Me-VP glass-Me (Me=Au, Al) have been prepared. The I-V characteristics are nonlinear in all cases but thermal switching has been observed only in Al-VP glass-Al structure. Presence of VO_2 was identified from XPS studies in the vanadium phosphate glass in the post breakdown state. (15 refs.)

73.60 ELECTRONIC PROPERTIES OF THIN FILMS

119716 The properties of Cr-Si-O thin film resistors by DC conventional sputtering. K.Furuta, S.Miyagawa (Totsuka Works, Hitachi Ltd., Yokohama, Japan), T.Kamei, H.Ando.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1565-6 (1983).
Cr-Si-O thin film resistors deposited by DC conventional sputtering and subjected to a proper stabilization heat treatment have been shown to have excellent resistance against oxidation and good stability over a long period of time. The sputter current dependence of the electrical properties and microstructure of the Cr-Si-O is highlighted. (4 refs.)

119717 Physical interpretation of weak localization: a time-of-flight experiment with conduction electrons. G.Bergmann (Inst. fur Festkorperforschung, Kernforschungsanlage Julich, Julich, Germany).
Phys. Rev. B (USA), vol.28, no.6, p.2914-20 (15 Sept. 1983).
The resistance of two-dimensional electron systems such as thin disordered films shows deviations from Boltmann theory, which are caused by quantum corrections and are called 'weak localization'. Theoretically, weak localization is originated by the Langer-Neal graph in the Kubo formalism. In the present paper this graph is translated into a transparent physical picture. It represents an interference experiment with conduction electrons split into pairs of waves interfering in the backscattering direction. The intensity of the interference (integrated over the time) can be easily measured by the resistance of the film. A simple derivation for this quantum correction to the resistance is given. A magnetic field introduces a magnetic phase shift in the electronic wave function and suppresses the intereference after a 'flight' time proportional to $1/H$. Therefore, the application of a magnetic field allows observation of the fate of the electron as a function of time. Spin-orbit coupling rotates the spin of the electrons and yields an observable destructive interference, thereby demonstrating the change of sign of the electron-spin function by rotation. Magnetic impurities destroy the coherence of the phase. Therefore, with magnetoresistance measurements one can determine the inelastic lifetime, the spin-orbit coupling time, and the magnetic scattering time of the conduction electrons. (43 refs.)

Doping kinetics of polyacetylene in the short range .... See Entry 119042

Electrically conductive polymer-polymer composites .... See Entry 119604

73.60D Metallic thin films

119718 Electrical, optical, and structural properties of semitransparent metallic layers. S.Kar, R.Varghese, S.Bhattacharya (Dept. of Electrical Engng., Indian Inst. of Technol., Kanpur, India).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1420-4 (1983).
Electrical, optical, and structural properties of ultrathin films of Ag, Au, and Al were investigated. MOS solar cells were fabricated with Ag, and Au barrier metals on *n*-type and with Al barrier metal on *p*-type silicon. The short-circuit current density J_{sc} was measured as a function of the average metal layer thickness t_n. The film structure was examined under a transmission electron microscope. The optical transmittance T was measured as a function of the wavelength λ with t_m as a parameter. The transmission electromicrographs indicated that, in the Ag and Au case, the film network structure attained electrical continuity at a lower value of t_m than in the case of Al. Also, in the Ag and Au case, surface covered by the film was lower. Largely due to this, optical transmittance was higher in the Ag and Au case than in the case of Al. The $T(\lambda)$ characteristics exhibited strong features in the Ag and Au case but not in the Al case. The profiles of $J_{sc}(t_m)$ were found to be peaked with the maximum occurring around 55 Å for Ag and Au and around 70 Å for Al. Furthermore, the peaks were sharp in the Al case, but were broad in the Ag and Au case. Also, the peak values were larger in the

Ag and Au case. The higher rate of degradation of Ag and Au MOS cells than AlMOS cells can be related to the presence of large discontinuity in Ag and Au films. (10 refs.)

119719 Electrical conductivity of non-homogeneous Au films on glass. G.Grimvall (Dept. of Theoretical Phys., Royal Inst. of Technol., Stockholm, Sweden), T.G.Andersson.
J. Phys. D (GB), vol.16, no.10, p.1985-91 (14 Oct. 1983).
The sheet resistance has been measured at room temperature for non-homogeneous thin gold films deposited on a glass substrate. A non-ohmic behaviour is observed when the applied electric field exceeds a certain critical value which varies strongly with surface coverage. An effective two-phase conductivity model gives a good qualitative account of the observed sheet resistance and the critical field as a function of the amount of metal deposited. (11 refs.)

119720 Effects of 'weak' localization and of electron-electon interaction in thin copper and silver films. M.E.Gershenzon, B.N.Gubankov, Yu.E.Zhuravlev (Inst. of Radio Engng. & Electronics, Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.6, p.1362-9 (Dec. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.6, p.2348-61 (Dec. 1982). [received: Oct. 1983]
The temperature and field dependences of the resistance of thin copper and silver films with surface-square resistances $R_{\square} \approx 3\text{-}400\Omega$ were investigated at temperatures T=1.4-100K and in magnetic fields H=0-70 kOe parallel as well as perpendicular to the film plane. The observed R(T) and R(H) dependences can be explained within the framework of a theory that takes into account the joint manifestations of the effects of 'weak' localization and electron-electron interaction in two-dimensional disordered systems. A comparison of the experimental data with the theory yields information on the energy and spin relaxation of the conduction electrons. (27 refs.)

Extraordinary Hall resistivity in amorphous terbium-iron thin films and its temperature dependence ....See Entry 119546

Optical properties of laser-melt-quenched Au-Si alloys ....See Entry 120173

73.60F Semiconductor films

119721 Carrier depletion in sulfur doped epitaxial GaAs layer by boron ion implantation. T.Itoh, M.Nomura (School of Sci. & Engng., Waseda Univ., Tokyo, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L389-90 (July 1983).
The carrier depletion by boron ion implantation in sulfur doped epitaxial GaAs layers has been investigated. The diffusion coefficient of boron in GaAs is rather small and the carrier depleted region in a sulfur doped epi-layer formed by boron ion implantation remains stable after a thermal treatment at 800°C for 20 min by the powder annealing method. The implanted boron atoms deplete carriers in the sulfur doped layer, and concentration profiles of calculated residual carriers using an empirical formula agree well with experimental results. (8 refs.)

119722 Characterization of SOS films grown with amorphous Si buffer layers by MOS FETs. M.Ishida, Y.Yasuda, H.Wakamatsu, H.Abe, T.Nishinaga, T.Nakamura (Dept. of Electrical Engng., Toyohashi Univ. of Technol., Toyohashi, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L438-40 (July 1983).
Electrical properties of Si films grown epitaxially on sapphire substrates with amorphous Si buffer layers (less than 40 Å) have been studied by fabricating n-channel MOS FETs. The effective mobility of the MOS FETs fabricated on SOS with the buffer layer was 1.36 to 1.5 times as large as the one without the buffer layer, at $V_G - V_T = 4$ V. The SOS film was grown at a slow growth rate (550 Å/min) and thickness was 0.55 μm. This result indicates that the present growth method is useful for thinning Si films as VLSI devices. (7 refs.)

119723 A study on the purity and SIMS profiling of MOVPE-cadmium mercury telluride. J.B.Mullin, S.J.C.Irvine, A.Royle, J.Tunnicliffe (Royal Signals & Radar Establ., Great Malvern, England), G.Blackmore, R.Holland.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1612-14 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
A preliminary study has been carried out on the electrical properties and chemical purity of epitaxial layers of cadmium mercury telluride (CMT) grown by metal-organic vapor phase epitaxy (MOVPE). It has been shown that the mobility of such layers grown at 410°C are comparable with bulk CMT of equivalent carrier concentration. SIMS profile studies of trace impurities in the epitaxial layers and CdTe substrates used for epitaxial deposition revealed significant impurity concentration enhancement (ICE effect) for a number of elements (Li,Na,K,Al,Ga,In, and Mn) at the CdTe/CMT interface: some of these elements (Li,Na,K,Al and In) also showed this ice effect at the subsequent CMT/CdTe interface. The magnitude of the ICE effect could be quite large (a factor ~100 for Li) but its origin was not identified although potential mechanisms for its formation are discussed. (10 refs.)

119724 Minority carrier lifetime in LPE $Hg_{1-x}Cd_xTe$. J.Bajaj, S.H.Shin, J.G.Pasko, M.Khoshnevisan (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1749-51 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
The authors report measurements on the minority carrier lifetime in *n*-type and *p*-type LPE $Hg_{1-x}Cd_xTe$/CdTe with $x \sim 0.2$. For *n*-HgCdTe, they have measured lifetimes of 4-7 μs at 77K for passivated samples. These values are comparable to the results reported for bulk material. For *p*-HgCdTe epilayers with thickness ≤20 μm, the measured lifetime is 15-20 ns at 77K and is suspected to be limited by surface recombination. With excitation through the CdT substrate, they have attempted to measure the bulk lifetime; preliminary results are reported. (5 refs.)

119725 Conductivity of heterocondensates of CdTe. I.V.Zavalin, I.V.Potykevich, N.B.Kuleshov (Inst. of Cybernetics, Acad. of Sci., Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.10, p.1464-7 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1705-8 (Oct. 1982). [received: Sept. 1983]
The electrical conductivity of cadmium telluride films was studied over a wide temperature range for different values of the nucleation parameters and growth parameters of the films. The conductivity of single-crystal CdTe films varies nonmonotonically with the rate of deposition of the condensate. A film thickness equal to 6 μm is characteristic, since at 330K the depth of the Debye curvature of the bands equals 6.1 μm. (3 refs.)

119726 Semiconducting behavior of Ag_2Te thin films and the dependence of band gap on thickness. V.Damodara Das, D.Karunakaran (Dept. of Phys., Indian Inst. of Technol., Madras, India).
J. Appl. Phys. (USA), vol.54, no.9, p.5252-5 (Sept. 1983).
Thin films of Ag_2Te of various thicknesses in the range 500-1500 Å have been prepared by thermal evaporation of the compound under vacuum on clean glass substrates held at room temperature. The electrical resistance of the films has been measured as a function of temperature during heating, which was carried out immediately after the film formation. The observed exponential decrease of resistance with temperature up to the transition point points to the semiconducting nature of the low temperature polymorph of Ag_2Te. The band gap of the low temperature phase is calculated for various thicknesses of the films and it is found that the band gap is a function of film thickness, increasing with decreasing thickness. The increase in the band gap, which was found to be inversely proportional to the square of the film thickness, is attributed to quantization of the electron momentum component normal to the film plane. (24 refs.)

119727 Highly doped amorphous silicon without hydrogen. R.W.Fane, Y.Zaka (Dept. of Phys., Univ. of Aston, Birmingham, England).
J. Phys. D (GB), vol.16, no.10, p.1993-8 (14 Oct. 1983).
Amorphous silicon films with high intrinsic resistivity have been produced by RF sputtering without the addition of hydrogen or halogen. Co-sputtering with tantalum resulted in n-type material with resistivity<1 Ω cm and a shift in the Fermi level of 0.6 eV. (16 refs.)

119728 Substituted polyacetylenes by cyclopolymerization: poly(1,6-heptadiyne) and poly(propiolic anhydride). H.W.Gibson (Webster Res. Center, Xerox Corp., Webster, NY, USA), A.J.Epstein, H.Rommelmann, D.B.Tanner, Xiao-Quing, Yang, J.M.Pochan.
J. Phys. Colloq. (France), vol.44, no.C-3, p.651-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Two substituted polyacetylenes, poly(1,6-heptadiyne) and poly(propiolic anhydride), have been synthesized by cyclopolymerization of diacetylenic precursors. The former polymer has been examined in some detail. Under suitable conditions, it can be doped to a conductivity (σ) of ~1 s/cm. It displays a number of contrasts to polyacetylene in its morphology, lack of crystallinity, and electron spin resonance behavior. Poly(propiolic anhydride) has been examined only in a preliminary manner; however, this system offers the possibility for generation of a range of substitutents by facile modification of the starting monomer or the product polymer. Cyclopolymerization is a feasible route for synthesis of a family of conducting polymers. (18 refs.)

119729 Synthesis and characterization of highly conducting, environmentally stable, iodine complexes of a soluble poly N-methyl 3,3′ carbazolyl. S.T.Wellinghoff (Univ. of Minnesota, Minneapolis, MN, USA), T.Kedrowski, S.Jenekhe, H.Ishida.
J. Phys. Colloq. (France), vol.44, no.C-3, p.677-81 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Polly N-methyl 3′,3 carbazoly (PC) can be prepared by forming the di-Grignard reagent of 3′,3 dibromo N-methyl carbazole with highly activated magnesium and subsequently adding this reagent to a tetrahydrofuran suspension containing a catalytic amount of nickle complex. The tan yellow PC isolated from this reaction mixture was soluble in a number of 'acceptor' type solvents such as nitrobenzene. Thin, clear yellow films could be cast and were easily doped with I_2, Br_2 to form tough black films. Completely doped PC semiconductors containing one I atom per carbazole monomer unit, exhibited conductivities as high as 1 ohm^{-1} cm^{-1} with an activation energy for DC conduction of 0.172 eV. Together with the featureless absorbance spectrum shown by the I_2 doped films from 0.3 μ to 25 μ these electrical properties suggest hopping as the charge transport mechanism in these amorphous materials. The carbazole radical cations were sufficiently stable in the complexes to maintain this electrical conductivity unchanged in room air at 25°C for at least 1 month. (21 refs.)

119730 Electrical conductivity of doped polyacrylonitrile $(PAN)^+$. H.Teoh, D.MacInnes,Jr., P.D.Metz (Solar & Renewables Div., Brookhaven Nat. Lab., Upton, NY, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.687-91 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The electrical conductivity and optical absorption spectra of halogen doped PAN have been investigated. When films of PAN previously heated in vacuum to 280°C are exposed to bromine or iodine vapor the conductivity rises suddenly. The conductivity is reduced by pumping off the vapor, but upon subsequent reheating the conductivity increases dramatically, with a transition occurring at about 270°C. Undoped samples were previously reported to undergo a similar transition above 390°C. All samples obey $\sigma\ \alpha\ T^{-1/4}$ behavior, suggesting 3-dimensional variable range hopping as the conduction mechanism. The optical and infrared absorption spectra of doped PAN are compared to those previously reported for the undoped material. The stability of doped PAN in air is also discussed. (12 refs.)

119731 Temperature and thickness dependence of electrical conductivity of flash-evaporated InSb films. A.K.Sharma (Dept. of Phys., Sri Venkateswara Univ., Tirupati, India), P.Jayarama Reddy.
Phys. Status Solidi a (Germany), vol.79, no.1, p.183-8 (Sept. 1983).
The electrical conductivity as a function of film temperature, substrate temperature, and thickness is reported on InSb films flash evaporated onto gold seal glass, freshly cleaved mica and cleaved NaCl substrates in a vacuum of 6.7×10^{-4} Pa. Post deposition annealing shows an interesting behaviour in the electrical conductivity. The structure of the films is found to improve with substrate temperature and single crystal growth is observed at $T_s = 573$K. While the electrical conductivity shows an increasing behaviour with substrate temperature and thickness, the activation energy shows a decreasing trend. (11 refs.)

119732 Ion plated transparent conductive films. M.El-Sherbiny (King Abdulaziz Univ., Jeddah, Saudi Arabia), F.Salem, A.Aboukhashaba.
Vak.-Tech. (Germany), vol.32, no.6, p.168-73 (Sept. 1983).
Indium tin oxide (ITO) films are deposited by conventional reactive ion plating on glass substrates. Transparent conductive films of various compositions are tested for resistivity and optical transmission. Film nucleation and growth are investigated, and finally some adhesion test results are reported. Minimum resistivity is achieved with tin concentrations within the range of 30-40% whilst optical transmission is fluctuating above a minimum of 82% for wavelengths within the range of 500-1000 nm. (14 refs.)

Some aspects of Li behavior in ion implanted HgCdTe ....See Entry 119052

Growth and photoluminescence spectra of high-purity liquid phase epitaxial $In_{0.53}Ga_{0.47}As$ ....See Entry 119363

Characterizaiton of eptiaxial films of CdTe and CdS grown by hot-walled epitaxy ....See Entry 119375

Spectral studies on the electronic structure of polyacetylene . See Entry 119408

Trends in optical parameters and band structure with increasing hydrogenation of amorphous silicon ....See Entry 119418

Discrete intragap Pb states in $Pb_{1-x}Sr_xS$ ....See Entry 119499

Electronic and ionic transport properties of electrodeposited polypyrrole films . ...See Entry 119607

Amorphous silicon-phosphorus layer ....See Entry 119613

On the hole mobility of $CuGaSe_2$ ....See Entry 119617

Investigation of persistent photoconductivity in Si-doped n-$Al_xGa_{1-x}As$ grown by molecular beam epitaxy ....See Entry 119643

Surface and interface recombination in thin film HgCdTe photoconductors ....See Entry 119645

Study of space charge effects on photoconduction in amorphous $Se_{0.95}Te_{0.05}$ films using a three electrode system ....See Entry 119647

Anomalous photovoltaic effect in thin films of ZnSe obliquely deposited in vacuum ....See Entry 119652

Wide optical gap, undoped, photoconductive a-Si_xN_{1-x}:H prepared by DC sputtering ....See Entry 119662

Spectral dependences of the photoconductivity of thin cadmium-doped Dy_2S_3 and Yb_2S_3 films ....See Entry 119663

Transparent conducting zinc oxide and indium-tin oxide films prepared by modified reactive planar magnetron sputtering ....See Entry 120246

Radio-frequency sputtered indium tin oxide thin films ....See Entry 120248

High-purity InP grown by hydride VPE technique with impurity gettering by indium source and oxygen ....See Entry 120258

Horizontal slider LPE of (HgCd)Te ....See Entry 120266

Polymerization of acetylene with new catalysts, new doping agents, morphology and electrical conductivity of the doped polyacetylene films .. See Entry 120627

73.60H Insulating thin films

119733 Electron trapping/detrapping within thin SiO_2 films in the high field tunneling regime. P.Olivo, B.Ricco, E.Sangiorgi (Istituto di Elettronica, Univ. di Bologna, Bologna, Italy).
J. Appl. Phys. (USA), vol.54, no.9, p.5267-76 (Sept. 1983).
Presents the essential features of a model for the electrical behavior of thin SiO_2 films in the high field tunneling regime. In particular the carrier trapping/detrapping phenomena, taking place within the insulator and responsible for the current time dependence at constant applied voltages, are considered: the suggestion is proposed that all the oxide Si-O bonds take active part in such processes and explanations are consequently derived for some aspects of previous works not yet convincingly interpreted. The results of a computer program implementing the model are also presented and shown to be in satisfactory agreement with experimental curves which can be fit with a single variable parameter. (29 refs.)

Phototransients in anodic tantalum oxide thin films ....See Entry 119646

Physical and electrochemichromic properties of RF sputtered tungsten oxide films ....See Entry 120172

73.60K Superconducting films

Two-dimensional superconductors. Evidence of Coulomb-gas scaling ....See Entry 119755

Theory of far-infrared absorption in superconducting composites ....See Entry 120084

74.00 SUPERCONDUCTIVITY

74.10 OCCURRENCE, CRITICAL TEMPERATURE

119734 Dilemma of $EuMo_6X_8$ ($X=S$, Se)—possible solution. S.N.Ekbote, S.K.Gupta, A.V.Narlikar (Nat. Phys. Lab., New Delhi, India).
Curr. Sci. (India), vol.52, no.15, p.716-18 (5 Aug. 1983).
Amongst Chevrel phase compounds, $REMo_6X_8$, where RE:La, Ce, Pr, Eu, Gd, Lu, etc. and X:S, Se, Te, $EuMo_6S_8$ and $EuMo_6Se_8$ are of particular interest as both of them show rather unexpected properties which still remain to be understood. From theoretical considerations both of them are expected to exhibit superconductivity at ambient pressure with appreciable T_c, which is contrary to the experimental observations. Under a pressure of 7 kbar, however, $Eu_{1.2}Mo_6S_8$ becomes superconducting at about 11K whereas $Eu_{1.2}Mo_6Se_8$ does not show superconductivity up to pressures of 25 kbar. The reason for the dilemma is not unambiguously known and the suggested reasons like sharp variation of $N(E_F)^5$, and magnetic to nonmagnetic transitions for Eu ions are not found to be experimentally true. The ESR studies reported seem to resolve the dilemma. (21 refs.)

119735 Numerical calculation of temperature dependent superconducting transition in inhomogeneous superconductors. E.Yu.Klimenko, A.E.Trenin (Kurchatov Atomic Energy Inst., Moscow, USSR).
Cryogenics (GB), vol.23, no.10, p.527-30 (Oct. 1983).
The temperature dependent calculation of the resistance of a series-parallel circuit consisting of superconducting elements and the critical temperatures described by the Gaussian distribution, permits a semi-empirical description of the type-III superconductor transition. $E=\rho_n j\exp(-Tc/To+T/To+B/Bo+j/jo)$. An explanation of the experimentally observed dependence of the increasing parameters on the magnetic field and temperature is given on the basis of the calculation results. (9 refs.)

119736 Normal to ferromagnetic superconducting transition. P.Bhattacharyya (Tata Inst. of Fundamental Res., Bombay, India).
J. Phys. C (GB), vol.16, no.28, p.L1011-14 (10 Oct. 1983).
A lattice model of the electromagnetically coupled ferromagnetic superconductor is studied. It is argued that the transition from the normal state to one in which superconductivity coexists with uniform magnetisation should show an inverted λ anomaly and under suitable conditions could be experimentally detectable. The contrasts with earlier predictions of a fluctuation-induced first-order transition. (12 refs.)

119737 Cooperative phenomenon in ternary superconductors. S.L.Kakani (Dept. of Phys., MLV Government Coll., Bhilwra, India).
J. Low Temp. Phys. (USA), vol.53, no.1-2, p.221-53 (Oct. 1983).
A microscopic theory of ferromagnetic superconductors is developed from first principles. Self-consistent equations for the superconducting order parameter Δ and spontaneous magnetization $<S^z>$ are derived using a Green's function technique and considering the *f-d* exchange effect up to the second order. The theory is applied to explain the experimental results in the reentrant superconducting ternary system $ErRh_4B_4$. The present model explains reentrant behaviour, predicts the coexistence of superconductivity and ferromagnetism in a very small range of temperature, the suppression of superconductivity by ferromagnetism, and vice versa. These results are in excellent agreement with the experimental data and predictions of other models. The behaviour of the spontaneous magnetization, the superconducting order parameter, the specific heat, and the density of states is also studied. (66 refs.)

119738 The Bechgaard phase, asymmetric anions and $T_c>3K$. R.C.Lacoe, P.M.Chaikin (Dept. of Phys., Univ. of California, Los Angeles, CA, USA), F.Wudl, E.Aharon-Shalom.
J. Phys. Colloq. (France), vol.44, no.C-3, p.767-74 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors have synthesized a new organic conducting salt utilizing a small asymmetric anion with a permanent dipole moment: $(TMTSF)_2FSO_3$. The phase diagram is very similar to that of the ReO_4^- salt, exhibiting an anion ordering and simultaneous metal-insulator transition at low pressure, a 'glassy' phase for P~6 kbar, and superconductivity for higher pressures. The superconducting transition temperature is the highest yet observed for an organic conductor with an onset above 3K and a midpoint for the transition above 2K. The authors present anisotropic critical field data for the superconducting phase and transport measurements for the glass phase. (22 refs.)

119739 Organic superconductors: three years only!. D.Jerome (Lab. de Phys des Solides, Univ. Paris-Sud, Orsay, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.775-82 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The author gives an overview on the rapidly expanding field of organic superconductors. The numerous amount of experimental data which suggests that their one-dimensional physics is closely related to their physical properties is particularly emphasized. (36 refs.)

119740 A sulphur based organic molecular superconductor: $(BEDT\text{-}TTF)_4(ReO_4)_2$. S.S.P.Parkin, E.M.Engler, R.R.Schumaker, R.Lagier, V.Y.Lee, J.Voiron, K.Carneiro, J.C.Scott, R.L.Greene (IBM Res. Lab., San Jose, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.791-7 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors have prepared a number of salts of the sulphur derived organic molecule, BEDT-TTF, with various anions including ReO_4, ClO_4, BF_4, PF_6 and Br. For the same anion, salt with various stoichiometries are found. For the ReO_4 anion, they have so far identified four different phases. The 2:1 salt, $(BEDT\text{-}TTF)_4(ReO_4)_2$, becomes superconducting for pressures above ~4 kbar with a transition temperature near 2K. At higher pressures, T_c falls rapidly at a rate, $dT_c/dP \sim -0.3K/kbar$. At lower pressures this salt exhibits a first order metal-insulator transition near 80K which they suggest is associated with a rearrangement of the ReO_4 anions which are ordered at room temperature. (17 refs.)

119741 Superconductivity and metal-nonmetal transitions in $(TMTSF)_2ClO_4$. T.Ishiguro, K.Murata, K.Kajimura, N.Kinoshita, H.Tokumoto, M.Tokumoto (Electrotech. Lab., Ibaraki, Japan), T.Ukachi, H.Anzai, G.Saito.
J. Phys. Colloq. (France), vol.44, no.C-3, p.831-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
$(TMTSF)_2ClO_4$ undergoes the metal-nonmetal (MN) transition above the superconductivity (SC) transition under a certain condition. The SC and MN transitions are influenced by resistance jumps and cooling speed across the order-disorder transition of ClO_4 anions. The interplay of the SC and SDW phases is discussed with regard to these influences. (21 refs.)

119742 Transport properties under pressure of the organic conductors $(TMTTF)_2X$; $X=PF_6$, ClO_4, Br. F.Creuzet, S.S.P.Parkin, D.Jerome, K.Bechgaard (Lab. de Phys. des Solides, Univ. de Paris-Sud, Orsay, France), J.M.Fabre.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1099-103 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
According to conductivity studies, the $(TMTTF)_2X$ series shows some similarities with the selenium series. However, the critical pressure, corresponding to the suppression of the insulating ground state, 25 kbar for the bromide salt, is much higher and may be related to the stronger dimerization of the organic molecules along the stack. The authors have examined the possibility of superconductivity in $(TMTTF)_2Br$ by conductivity, AC susceptibility and magnetoresistance experiments. Although the existence of a superconducting transition around 3K is not yet fully demonstrated, superconducting short range order may be important at low temperature. (10 refs.)

119743 Coexistence of superconductivity and spin density waves: $(TMTSF)_2X$. E.W.Fenton, G.C.Psaltakis (Div. of Phys., Nat. Res. Council of Canada, Ottawa, Canada).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1129-32 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
When superconductivity coexists with a spin density wave for the same electrons, both spin-singlet and spin-triplet Cooper pair amplitudes must be significantly large. Physical properties of the coexistence state are strongly affected by the amplitude of spin-triplet Cooper pairs even when the electron-electron

interaction for triplet pairing and the triplet pair potential Δ_{TS} are both zero. (2 refs.)

119744 Correlation between superconductivity and charge-density-waves in $Nb_{1-x}Ta_xSe_3$. K.Kawabata, M.Ido, T.Sambongi (Dept. of Phys., Hokkaido Univ., Sapporo, Japan).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1647-50 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Superconducting and charge-density-wave transitions in $Nb_{1-x}Ta_xSe_3$ were examined. With addition of Ta the superconducting transition temperature Tc increases steeply up to 1.7K and begins to decrease gradually above 4.5 at.%. Such an impurity dependence of Tc can be understood in terms of the correlation with CDWs. (15 refs.)

119745 Third-harmonic susceptibility $|\chi_3|$ of quasi-one-dimensional superconductors Nb_3S_4, Nb_3Se_4, and Nb_3Te_4. T.Ishida, H.Mazaki (Inst. for Chem. Res., Kyoto Univ., Kyoto, Japan), I.Nakada.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1701-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Superconducting transition of Nb_3S_4, Nb_3Se_4, and Nb_3Te_4 has been studied in terms of fundamental and third-harmonic susceptibility. The authors give an evidence that the randomness in interchain couplings is responsible for the AC response. (6 refs.)

119746 Conduction properties of $ZrTe_3$. S.Takahashi, T.Sambongi, S.Okada (Dept. of Phys., Hokkaido Univ., Sapporo, Japan).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1733-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
$ZrTe_3$ shows a metallic resistivity and becomes superconducting at 2.0K. The anisotropy of both the resistivity and the upper critical field are two-dimensional. The transverse resistivity exhibits an anomalous hump near 70K, while there is no anomaly in the longitudinal component. The authors' temporary estimate is that this anomaly is caused by an additional scattering rather than a reduction of carriers. (7 refs.)

119747 Some properties of superconducting virtual-bound-state alloys. Y.Okabe, A.D.S.Nagi (Dept. of Phys., Univ. of Waterloo, Waterloo, Ontario, Canada).
Phys. Rev. B (USA), vol.28, no.5, p.2455-62 (1 Sept. 1983).
Using the Anderson model in the nonmagnetic limit, the authors have calculated some properties of the superconducting virtual-bound-state alloys. The calculated properties are the transition temperature T_c, the jump in specific heat at T_c, ΔC, the electronic density of states, and the tunnelling conductance. Special attention is paid to the systematic variation of these properties with the resonance width Γ. It is found that the initial slope of the normalised ΔC versus the normalised T_c curve has a maximum value of 3.638, which is the highest value reported in the literature for the impurity problem. The tunneling study suggests that for an electron-tunnelling search of bound states in alloys with relatively large Γ, an ultra-low temperature experiment is desirable. (17 refs.)

119748 Superconducting T_c for the separable model of (ϵ,ϵ') variation in $\alpha^2F(\epsilon,\epsilon';\Omega)$. B.Mitrovic (Dept. of Phys., State Univ. of New York, Stony Brook, NY, USA), J.P.Carbotte.
Phys. Rev. B (USA), vol.28, no.5, p.2477-84 (1 Sept. 1983).
The authors have derived and numerically solved a set of equations for the superconducting critical temperature T_c in the case of the separable model of electronic energy dependence in the electron-phonon coupling function $\alpha^2F(\epsilon,\epsilon';\Omega)=[1+a(\epsilon)]\alpha^2(\Omega)F(\Omega)[1+a(\epsilon')]$ analogous to the well-known separable model for anisotropy in α^2F. It is shown that to a good approximation the (ϵ,ϵ') dependence of α^2F can be ignored in calculating T_c provided the electronic density of states $N(\epsilon)$ is replaced by $N(\epsilon)[1+a(\epsilon)]^2$. They also consider the effect of scattering by normal impurities. This scattering effectively smears out the (ϵ,ϵ') dependence of α^2F which is analogous to the smearing of the structure in $N(\epsilon)$ by impurity scattering. (18 refs.)

119749 The effect of atomic order on the superconducting properties of A-15 Nb_3Au and $Nb_3Au_{1-x}Pt_x$ alloys. M.S.Wire, G.W.Webb (Inst. for Pure & Appl. Phys. Sci., Univ. of California, San Diego, La Jolla, CA, USA), D.E.Cox, C.L.Snead,Jr., A.R.Sweedler.
Solid State Commun. (USA), vol.48, no.2, p.125-7 (Oct. 1983).
The superconducting transition temperature, T_c, of pseudobinary A-15 $Nb_3Au_{1-x}Pt_x$ exhibits a broad maximum at $x=0.3$. Since the T_c of Nb_3Pt is known to be strongly dependent on atomic order, the authors have measured the long range order parameter of $Nb_3Au_{1-x}Pt_x$ alloys by X-ray diffraction techniques. They found these alloys to be almost fully ordered. They also investigated the effects of reactor-spectrum neutron irradiation on the T_c of Nb_3Au. As in the case of Nb_3Pt, T_c of Nb_3Au is strongly depressed with respect to the unirradiated value of 11K. They conclude that the peak of T_c in the $Nb_3Au_{1-x}Pt_x$ system cannot be explained on the basis of atomic ordering. (21 refs.)

119750 Critical temperature and density of states in amorphous $Zr_{70}Cu_{30}$. L.Civale, F.de la Cruz, J.Luzuriaga (Centro Atomico Bariloche, Bariloche, Argentina).
Solid State Commun. (USA), vol.48, no.4, p.389-91 (Oct. 1983).
By means of thermal heat treatment of amorphous $Zr_{70}Cr_{30}$ it is shown that the induced decrease in critical temperature is followed by a reduction in the electronic density of states of the same magnitude as that obtained by changing the Cu concentration. This result indicates that the density of states is the fundamental microscopic parameter determining the superconducting behavior. (14 refs.)

119751 Instabilities in the superconductivity and the resistivity of implanted $Pd_{1-y}Cu_yH_x$ thin layers. H.Wagner (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.47-55 (1983). In German.
The behaviour of resistivity and of superconductivity of thin PdCu alloy layers implanted with 10 keV hydrogen ions at liquid helium temperatures has been investigated. Critical transition temperatures of $T_c \leq 11.6K$ were reached. Layers with copper concentrations >40% exhibited lattice instabilities at large hydrogen concentrations. From the reversible and current dependent behaviour of the resistivity and of T_c it can be concluded that the lattice instability is connected with hydrogen outgassing from the lattice. Onset and intensity of outgassing are considerably affected by small temperature changes. The influence of the temperature and that of the radiation-induced lattice defects on the instability is discussed. (15 refs.)

Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals) ....See Entry 116923

Influence of the disorder potential of the anions on the ground state of the organic alloy $(TMTSF)_2(ClO_4)_{1-x}(ReO_4)_x$ ....See Entry 118994

Hydrogen bond formation and anion ordering in superconducting $(TMTSF)_2ClO_4$ and $(TMTSF)_2AsF_6$ ....See Entry 119003

Onset of rare earth behavior in the actinides ....See Entry 119498

Current-carrying states in superconducting channels with nonhomogeneities ....See Entry 119752

Quenched and relaxed low temperature states in $(TMTSF)_2ClO_4$ ....See Entry 119761

The magnetic field dependence of the specific heat in $(TMTSF)_2ClO_4$ ....See Entry 119762

Characteristics of the specific heat of superconducting Laves phases ZrV_2 and HfV_2 ....See Entry 119763

Superconductivity? ....See Entry 119787

Physical properties of the TMTTF salts and TMTSF/TMTTF alloys: competition between the stacks instabilities ....See Entry 119810

Reentry and coexistence behavior of the magnetic superconductor $(Th_{1-x}Nd_x)Ru_2$ ....See Entry 119840

Local environment effects on the magnetic state of Fe in amorphous $Cu_{0.6}Zr_{0.4-x}Fe_x$ alloys ....See Entry 119853

Theory of far-infrared absorption in superconducting composites ....See Entry 120084

74.20 THEORY

119752 Current-carrying states in superconducting channels with nonhomogeneities. B.I.Ivlev, N.B.Kopnin, I.A.Larkin (L.D. Landau Inst. for Theoretical Phys., Acad. of Sci., Moscow, USSR).
J. Low Temp. Phys. (USA), vol.53, no.1-2, p.153-76 (Oct. 1983).
The stability of a current-carrying normal state in a superconducting channel with nonhomogeneities is considered at $T<T_c$. A value of the current is found below which the normal state becomes absolutely unstable with respect to nucleation and growth of a superconducting domain. Furthermore, the superconducting state appearing near a nonhomogeneity characterized by a critical temperature T_{c1} higher than the critical temperature T_c of the main material is studied for the case of $T>T_c$. (17 refs.)

119753 Excitonic superconductivity—the missing link. W.A.Little (Phys. Dept., Stanford Univ., Stanford, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.819-25 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors discuss the factors which determine the strength of the excitonic coupling constant and show that, in general, it will be small. However, they show that by proper choice of the system and its energy levels, strong coupling should be possible. In this case superconductivity at higher temperatures should occur. (17 refs.)

119754 Generation of charge imbalance in a superconductor by non-uniform temperature gradient. B.A.Mattoo, Y.Singh (Dept. of Phys., Univ. of Kashmir, Srinagar, India).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.51-6 (July 1983).
Using a generalized two fluid picture for the charge of a superconductor the authors study the creation of charge imbalance due to non-uniform temperature gradient. They compare their results with those obtained by other techniques. (10 refs.)

119755 Two-dimensional superconductors. Evidence of Coulomb-gas scaling. P.Minnhagen (Dept. of Theoretical Phys., Lund Univ., Lund, Sweden).
Phys. Rev. B (USA), vol.28, no.5, p.2463-7 (1 Sept. 1983).
Recent data for the *I-V* characteristics of thin high-sheet-resistance Hg-Xe alloy films are analyzed. It is found that the Coulomb-gas scaling is borne out to an excellent degree. This gives clear evidence that the observed nonlinear *I-V* characteristics and the resistive tail are caused by vortex fluctuations. (21 refs.)

Coexistence of superconductivity and spin density waves: $(TMTSF)_2X$ ....See Entry 119743

Some properties of superconducting virtual-bound-state alloys ....See Entry 119747

Superconducting T_c for the separable model of (ϵ,ϵ') variation in $\alpha^2F(\epsilon,\epsilon';\Omega)$ ....See Entry 119748

Lifetime broadening effects in normal and superconducting states of A-15 materials ....See Entry 119772

On the flux jumps in hard superconductors ....See Entry 119795

74.30 GENERAL PROPERTIES

119756 Low field ESR in the superconducting relaxed state of $(TMTSF)_2ClO_4$ at low temperature. J.M.Delrieu, N.S.Sullivan, K.Bechgaard.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1033-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors present the first observation of the conduction electron paramagnetic resonance in the mixed superconducting state of $(TMTSF)_2ClO_4$. (9 refs.)

119757 High field magnetoresistance measurements of $(TMTSF)_2ClO_4$. R.Brusetti, K.Bechgaard (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France), G.G.Lonzarich, R.H.Friend.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1055-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors report measurements of the magnetoresistance of $(TMTSF)_2ClO_4$ in the temperature range 0.3-1K and with fields up to 110 kG. They observe oscillations above a field H_t which depends on temperature. The frequencies of the oscillations and the magnetoresistance anisotropy are also field and

temperature dependent, which supports the picture of a field-induced transition to a semimetallic SDW phase. (9 refs.)

119758 Magnetoresistance of $(TMTSF)_2ClO_4$. K.Kajimura, H.Tokumoto, M.Tokumoto, K.Murata, T.Ukachi, H.Anzai, T.Ishiguro (Electrotech. Lab., Ibaraki, Japan), G.Saito.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1059-62 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Transverse magnetoresistance of $(TMTSF)_2ClO_4$ was found to exhibit Shubnikov-de Haas-type oscillation whose fields were strongly temperature dependent. The oscillation had no periodicity in the inverse field and exhibited a clear hysteresis around 90 kOe. These experimental facts suggest that there are closed orbits on the Fermi surface and energy band structures are altered by the magnetic field. (15 refs.)

Low temperature transport measurements on $(TMTSF)_2ClO_4$ .... See Entry 119565

Transport properties under pressure of the organic conductors $(TMTTF)_2X$; $X=PF_6$, ClO_4, Br .... See Entry 119742

Superconducting T_c for the separable model of (ϵ,ϵ') variation in $\alpha^2F(\epsilon,\epsilon';\Omega)$ .... See Entry 119748

Critical temperature and density of states in amorphous $Zr_{70}Cu_{30}$ .... See Entry 119750

Theory of far-infrared absorption in superconducting composites .... See Entry 120084

74.30C Magnetization curves, Meissner effect, penetration depth

119759 Anisotropy of the Meissner effect and the diamagnetic shielding in $(TMTSF)_2ClO_4$. D.Mailly, M.Ribault, K.Bechgaard (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1037-40 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors have measured the magnetic properties of $(TMTSF)_2ClO_4$ at low temperature. The critical fields H_{C1} and the Meissner signal show the anisotropy of the tridimensional coupling of the superconductivity. (16 refs.)

119760 Diamagnetic anisotropy, isotope shift and cooling-speed effects in superconducting $(TMTSF)_2ClO_4$ crystals. H.Schwenk, K.Andres (ZTTF, Garching, Germany), F.Wudl, E.Aharon-Shalom.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1041-5 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
For fields along the a-axis the low field diamagnetic shielding signals are strongly dependent on the thickness (b* and c* dimensions) of the crystals, which the authors explain by a macroscopically large London penetration depth for this orientation. The Meissner effect for fields in the b*/c* plane is strongly anisotropic. They further discuss the isotope shift between deuterated and non-deuterated crystals, the dependence of their superconductivity on the cooling speed, and their remarkable twinning properties at room temperature. (10 refs.)

74.30E Thermodynamic properties; thermal conductivity

119761 Quenched and relaxed low temperature states in $(TMTSF)_2ClO_4$. P.Garoche, R.Brusetti, K.Bechgaard (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1047-50 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Specific heat measurements on $(TMTSF)_2ClO_4$ demonstrate that the superconducting state is strongly distabilized when the sample is quenched from 40K. The relaxed state can be restored by annealing. The data show that, in the quenched state at OK, the superconducting phase is mixed with a semimetallic magnetic phase. (10 refs.)

119762 The magnetic field dependence of the specific heat in $(TMTSF)_2ClO_4$. R.Brusetti, P.Garoche, K.Bechgaard (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1051-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors have measured the specific heat of $(TMTSF)_2ClO_4$ between 0.2K and 2K in magnetic fields ($H \lesssim 63$ kOe) parallel to c*. The field strongly affects the electronic contribution γT and the results show that two competing mechanisms are involved: increasing the field yields a strong first increase of γ, it is followed by a decrease of γ which announces and anticipates the condensation of a non-metallic ground state. (13 refs.)

119763 Characteristics of the specific heat of superconducting Laves phases ZrV_2 and HfV_2. I.E.Bulakh, A.M.Gabovich, A.E.Morozovskii, V.M.Pan, A.S.Shpigel' (Inst. of Metal Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.504-5 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.880-2 (March 1983). [received: Oct. 1983]
The authors have determined the specific heat $C_p(T)$ of ZrV_2 and HfV_2 and paid special attention to the nature of the anomalies of these curves near the critical temperature T_c of the superconducting transition. The need for a detailed study of the behavior of the specific heat in the vicinity of T_c arises from the predicted reduction in the specific heat discontinuity $\Delta C_p(Tc)$ of systems with partial 'dielectrization' of the electron spectrum. (7 refs.)

Cooperative phenomenon in ternary superconductors .... See Entry 119737

Some properties of superconducting virtual-bound-state alloys .... See Entry 119747

Magnetoresistance and critical field measurements on the magnetic superconductor Y_4Co_3 .... See Entry 119786

74.30G Response to electromagnetic fields, nuclear magnetic resonance, ultrasonic attenuation

119764 Quantum oscillations of the ultrasound attenuation in bismuth. J.Dominec (Inst. of Phys., Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.5-6, p.333-6 (1983).
The attenuation of ultrasound waves was measured for the wave vector along the trigonal axis. The magnetic field was also applied in this direction. The oscillations of the attenuation of longitudinal waves are attributed to hole levels, the oscillations of shear waves to electron levels. This phenomenon is explained on the basis of the theory of Mase et al. (1981). (6 refs.)

119765 A magnetic state in the organic superconductor $(TMTSF)_2ClO_4$: cooling rate and strong magnetic field effects. T.Takahashi, D.Jerome, K.Bechgaard (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.805-11 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
^1H and ^{77}Se-NMR on an oriented single crystal of the organic superconductor $(TMTSF)_2ClO_4$ reveal that a magnetic state is stabilized by two different ways. One is the introduction of anion disorder by rapid cooling of the crystal (O-state): a cooling rate of about 2K/sec gives an almost field-independent magnetic transition at about 3.7K. In a slowly cooled sample (cooling rate $\lesssim 0.2$K/min, R-state), a strong magnetic field induces a magnetic state below 2.15K at 74 kOe. This state corresponds to the field induced semi-metallic phase observed by specific heat and Shubnikov-de Haas measurements. (26 refs.)

119766 Response of an organic superconductor to an electromagnetic field. G.C.Psaltakis, E.W.Fenton (Div. of Phys., Nat. Res. Council of Canada, Ottawa, Canada).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1125-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The response to a transverse vector potential $A(q,\omega)$ of superconductivity, spin-density-wave (SDW) and SDW-superconductivity coexistence state has been calculated. The predictions are expected to be relevant to far-infrared optical measurements on $(TMTSF)_2X$. (8 refs.)

The role of polaritons in superconductivity phenomenon [metal-dielectric contacts] .... See Entry 119467

Two-dimensional superconductors. Evidence of Coulomb-gas scaling .... See Entry 119755

Ultrasonic study of niobium in longitudinal magnetic fields .. See Entry 119784

74.40 FLUCTUATIONS AND CRITICAL EFFECTS

119767 Normal zone propagation within a superconducting magnetic system and cryostabilization of superconductivity. I.N.Nechiporenko (Acad. of Sci., Kharkov, Ukrainian SSR).
Cryogenics (GB), vol.23, no.10, p.549-53 (Oct. 1983).
A theoretical study of normal zone propagation along composite conductors in contact with liquid helium which accounts for the resulting rate of heat release and non-uniformity of heat conduction coefficient is described. The Maddock-James-Norris theorem is shown to be true only for a constant heat conduction coefficient. The formulae are given for the speed of the normal zone propagation. Equations have been obtained which describe the collapse dynamics or normal zone growth within the superconducting magnetic systems; time of collapse and normal zone growth being evaluated. Nonlinear heat waves of a new type are assumed to exist in a composite in addition to the solution with an interface of normal and superconducting regions. (16 refs.)

119768 Superconductivity and anomalous magnetotransport in $(TMTSF)_2ClO_4$. P.M.Chaikin, Mu-Yong Choi (Dept. of Phys., Univ. of California, Los Angeles, CA, USA), R.L.Greene.
J. Phys. Colloq. (France), vol.44, no.C-3, p.783-90 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The band structure parameters of $(TMTSF)_2ClO_4$ as measured in many experiments and as recent calculated suggest that the material can be viewed as one, two or three dimensional depending on the temperature range and the criteria used. The authors show that the superconductivity only occurs as a three-dimensional phenomena and that 1-dim high temperature superconducting fluctuations are inconsistent with a wide variety of experiments. They also discuss the magnetoresistance and magnetothermopower. Below ~30K the magnetotransport coefficients become larger and at low temperature quantum oscillations are observed above a threshold field. It is suggested that the threshold field for the oscillations is related to a crossover from quasi-three-dimensional to quasi-twodimensional behavior when $\hbar w_c \rangle 4t_c$, the bandwidth in the direction parallel to the magnetic field. (41 refs.)

High field magnetoresistance measurements of $(TMTSF)_2ClO_4$ .... See Entry 119757

Magnetoresistance of $(TMTSF)_2ClO_4$ .... See Entry 119758

74.50 PROXIMITY EFFECTS, TUNNELLING PHENOMENA, AND JOSEPHSON EFFECT

119769 Nonlinear behaviour of Josephson junction PLL analog. Z.J.Kowalik (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.3, p.357-9 (Sept. 1983).
The Josephson junction model (PLL) was investigated. Universal properties of the model, characteristic for a wide class of dissipative systems, i.e. bifurcations, intermittency, etc. were observed. (12 refs.)

119770 Fabrication of A15 Nb_3Al Josephson tunnel junction using CF_4 cleaning process. Y.Katoh, K.Tanabe, O.Michikami (Ibaraki Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Ibaraki, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L464-6 (July 1983).
A15 Nb_3Al thin-film Josephson tunnel junctions having an oxide barrier and a Pb counterelectrode have been fabricated by photolithogrpahy. Nb_3Al junction characteristics have been found to be drastically influenced by pre-cleaning conditions. Excellent junction qualities with low leakage current were achieved by adopting RF sputter-etching in $Ar+CF_4$ plasma as a pre-cleaning technique, instead of conventional Ar plasma. The chemical reaction of CF_4 radicals has been found to provide great utility for obtaining high quality tunnel junctions of an A15 Nb_3Al compound with a very short coherence length. (13 refs.)

119771 Anomalous microwave induced step behaviour in Josephson tunnel junctions. A.K.Gupta, V.S.Tomar, N.D.Kataria, M.P.S.Chauhan (Nat. Phys. Lab., New Delhi, India).
Indian J. Cryog., vol.8, no.2, p.81-5 (1983).
Lead-lead oxide-lead Josephson tunnel junctions are prepared in cross type geometry by deposition of lead films by thermal evaporation and by growing a suitable barrier by thermally oxidizing the surface of these films. The junctions are completed by depositing another film at right angles at the centre of the above film. These junctions have a reasonable pair current and show nearly ideal switching to energy gap in their I-V curves. However, they show some excess current below the gap region. The junctions when irradiated with microwaves show usual microwave induced constant voltage steps only at selected bands of microwave power levels. However, at power levels where amplitude of the zero voltage pair current approaches zero, the junction I-V characteristic shows negative differential resistance in their zeroth step. The magnitude of the negative swing changes systematically with the applied microwave power. The variation in the amplitude of the zeroth step with the square root of the microwave power does not strictly follow the Bessel function behaviour, but instead shows effects due to microwave induced excess currents. The overall behaviour is attributed to the growth of the nonequilibrium superconducting state. (14 refs.)

119772 Lifetime broadening effects in normal and superconducting states of A-15 materials. M.N.Mukherjee (Phys. Dept., Vidyasagar Coll., Calcutta, India), K.Pal.
Indian J. Cryog., vol.8, no.2, p.108-10 (1983).
Principal aspects of lifetime-broadening effects in A-15 superconducting materials are discussed. A method is suggested for the estimation of quasiparticle scattering rate in the superconducting state with a view to ascertaining the nature of the temperature dependence of quasiparticle lifetime. (11 refs.)

119773 Flux trapping in Josephson tunnel junctions. N.Uchida, K.Enpuku, Y.Matsugaki, S.Tomita, F.Irie (Dept. of Electronics, Kyushu Univ., Fukuoka, Japan), K.Yoshida.
J. Appl. Phys. (USA), vol.54, no.9, p.5287-92 (Sept. 1983).
Effects of flux trapping in the electrodes of Josephson tunnel junctions on junction characteristics are studied experimentally in the case of the field-cooling process. The suppression of the critical current and the increase of the quasiparticle current of the junction due to the trapped flux are measured. From the increase of the quasiparticle current, the amount of the flux trapped in junction electrodes is evaluated. The obtained amount of the trapped flux is discussed quantitatively on the basis of the pinning theory of nonideal type II superconductors, which gives the parameter of the electrodes characterizing the flux trapping. The relation between the amount of the suppression of the critical current and that of the trapped flux estimated from the quasiparticle current is studied quantitatively. It is shown that each trapped flux quantum suppresses the critical current of the junction by the ratio of about $\pi(6\lambda_L)^2/A$, where λ_L is the London penetration depth and A is the junction area. (23 refs.)

119774 Noise and the superconducting transition in self-heated tunnel junctions. T.A.Will, J.G.Adler (Dept. of Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
J. Low Temp. Phys. (USA), vol.53, no.1-2, p.23-40 (Oct. 1983).
Distinctive structure in the tunneling characteristics of junctions having a superconducting electrode arises at a bias V_0 where junction dissipation is sufficient to drive the electrode normal. While details of this structure are dependent upon junction-bath thermal linkage, in all cases a marked increase of junction conductance $\sigma(V)=dI/dV$ occurs at V_0 and this increase reflects an excess current at the superconducting-normal phase transition. In the case of Pb electrode junctions the transition in both normal and superfluid He occurs when junction dissipation triggers film boiling in the liquid. The authors discuss phase transition-induced tunneling structure, junction noise, and excess current for Pb electrode junctions in different thermal environments and consider the implications for tunneling spectroscopy and Josephson device applications. (24 refs.)

119775 Tunneling in organic superconductors. A.Fournel, C.More, G.Roger, J.P.Sorbier, C.Blanc (Dept. d'Electronique, Univ. de Provence, Marseille, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.879-84 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors present results obtained with tunnelling devices using the organic materials, $(TMTSF_2)PF_6$ and $(TMTSF)_2ClO_4$. The cooling rate has an effect on the appearance of the SDW state. In the relaxed state a modification of the density of states near 20K is observed. (8 refs.)

119776 High-resolution imaging of inhomogeneities in superconducting tunnel junctions by scanning with a modulated electron beam. H.Seifert, R.P.Huebener (Phys. Inst. II, Univ. Tubingen, Tubingen, Germany), P.W.Epperlein.
Phys. Lett. A (Netherlands), vol.97A, no.9, p.421-3 (26 Sept. 1983).
A two-dimensional image of spatial structures within a superconducting tunnel junction can be obtained by scanning the current-biased junction with an electron beam and detecting the voltage change. The resolution of this imaging technique is governed by the thermal-healing length which describes the spatial diffusion of the beam energy through the superconducting film. Due to the thermal skin effect this resolution can be improved remarkably by high-frequency modulation of the beam intensity and synchronous signal detection. (5 refs.)

119777 Theory of the Josephson effect in superconducting contacts at high voltages. A.V.Zaitsev (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.534-5 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.927-9 (March 1983). [received: Oct. 1983]
The author examines the nonsteady effect in superconducting contacts with constrictions at voltages $V\gg\Delta$ (V is assumed to be constant or to vary only slightly in a time of the order of Δ^{-1}). He considers the case of 'pure' constrictions whose characteristic dimension $a \ll l$, where l is the mean free path. (4 refs.)

119778 Random instability in Josephson junctions. V.N.Gubankov, K.I.Konstantinyan, V.P.Koshelets, G.A.Ovsyannikov (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.574-5 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1332-5 (Nov. 1982). [received: Sept. 1983]
The authors report the experimental observation and study of random oscillations in a Josephson junction with a voltage-current characteristic exhibiting hysteresis during the application of external microwave power. (9 refs.)

119779 Investigations on the structure of Nb-NbO_xPb-Josephson tunnel junctions. H.-J.Kohler, P.Seidel, P.Weber, K.Bluthner, S.Linke, T.Hadrich, K.-H.Berthel (Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.7-17 (1983). In German.
Nb-NbO_x-Pb tunnel junctions with tunnel areas of 100×100 μm^2 to 3×3 μm^2 are investigated. The temperature dependence of the current voltage characteristic, of the effective niobium energy gap and of the critical Josephson current are compared with the BCS curves. The deviation of the experimentally determined values is caused by a proximity effect model the parameters of this proximity layer can be found by fitting the calculated values to the experimental values. Moreover current density distributions in tunnel junctions are determined, which can be calculated from the dependence of the critical Josephson current on the magnetic field by means of a theoretical model. The dependences of the current density distributions on tunnel areas and the changes in time are investigated. (16 refs.)

119780 Adiabatic perturbation theory for external and mutual synchronization of Josephson elements. W.Krech (Sektion Phys., Freidrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.19-24 (1983). In German.
The author investigates the synchronization behaviour of a resistively shunted de-biased ($I>i_c$) Josephson element caused by a small AC signal. After variation of the constant phase in the autonomous solution and an adiabatic averaging procedure they derive equations for the slowly varying Josephson generation phase in arbitrary order of the signal amplitude. To the first order, the method is applied to determine the relative phase of two Josephson junctions in the case of SQUID coupling and parallel biasing. (8 refs.)

119781 The delay time in changeover switching from the superconducting to the normal-conducting state in In-Pb-In thin-film bridges. W.-D.Schmidt (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.25-30 (1983). In German.
The time delay until the occurrence of normal state conductivity of superconducting thin film bridges was investigated by means of two pulse-measuring methods. The results could be explained very well by a time-dependent Ginzburg-Landau model. The obtained relaxation time of the In-Pb-In thin-film system was of the order of 3ns. (11 refs.)

119782 Investigations of the current-induced resistive behaviour in long microbridges. H.Frohlich.
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.39-46 (1983). In German.
The current-induced resistive state in long superconducting microbridges over the transport current interval $0.5\ I_c<I<0.7\ I_c$ is determined by flux flow. Above this interval ohmic losses predominate. By means of this model the noise dependence of the transport current can be explained. (9 refs.)

Some properties of superconducting virtual-bound-state alloys .... See Entry 119747

74.60 TYPE-II SUPERCONDUCTIVITY

119783 Resonant drag of a type II superconductor cylinder by oscillating Abrikosov vortices. D.G.Driyaev, Dzh.G.Chigvinadze (Inst. of Phys., Acad. of Sci., Tbilisi, Georgian SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.509 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.887-8 (March 1983). [received: Oct. 1983]
If a cylindrical sample of a type II superconductor is suspended by an elastic filament and subjected to a magnetic field H exceeding the first critical value H_{c1} (but below the second critical value H_{c2}), such a cylinder becomes penetrated by the Abrikosov vortex line (fluxoids) and one magnetic flux quantum penetrates along each line into the sample. Such vortices influence the magnetic properties of the suspended system so that they can be investigated by mechanical methods. The authors have investigated the possibility of drag of the crystal lattice of such a sample by moving Abrikosov vortices. (3 refs.)

Lifetime broadening effects in normal and superconducting states of A-15 materials .... See Entry 119772

74.60E Mixed state, H_{c2}, surface sheath

119784 Ultrasonic study of niobium in longitudinal magnetic fields. K.Misek (Dept. of Low Temperatures, Inst. of Phys., Praha, Czechoslovakia).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.5-6, p.321-31 (1983).
Several types of hysteresis of ultrasound attentuation in niobium single crystals during transitions from the normal to the mixed state and from the mixed state to the superconducting state in longitudinal magnetic fields at 4.2K were observed. The lower critical field H_{c1} and the hysteresis near to it are structure sensitive. A qualitative discussion of the observed phenomena is given. (14 refs.)

119785 Note on upper critical field of heavy fermion superconductivity. K.Machida (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.2979-80 (Sept. 1983).
Effects of Fermi liquid parameters on the upper critical field H_{c2} are discussed theoretically. The Maki parameter which characterizes behavior of H_{c2} in the presence of the Pauli paramagnetic effect is found to be renormalized by electron-electron interaction. Experimental data on a 'heavy Fermion' superconductor $CeCu_2Si_2$ are analyzed. (6 refs.)

119786 Magnetoresistance and critical field measurements on the magnetic superconductor Y_4Co_3. C.Sulkowski, K.Rogacki (Inst. for Low Temperature & Structure Res., Polish Acad. of Sci., Wroclaw, Poland), A.Kolodziejczyk, G.Kozlowski, J.Chmist.
J. Phys. F (GB), vol.13, no.10, p.2147-53 (Oct. 1983).
The resistance and magnetoresistance of the intermetallic magnetic superconductor Y_4Co_3 were measured in the temperature range 1.74-4.2K and in fields of up to 1.1 T. The authors extracted the slope of the upper critical field near the superconducting transition, and the specific heat coefficient γ. The main conclusions are that the superconducting state is fully quenched just above the transition temperature, and that the authors are dealing with a dirty superconductor. Moreover, the specific heat coefficient γ calculated from theory is in good agreement with the experimental value. (18 refs.)

119787 Superconductivity?. M.Ribault (Lab. de Phys. des Solides, Univ. de Paris Sud, Orsay, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.827-30 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The author discusses the physical parameters identifying the superconducting ground state particularly the critical fields before giving new results on the quenched state of $(TMTSF)_2ClO_4$. A cooling rate of 4K/s leads to a low electrical conductivity material whereas a cooling rate of 10^{-3}K/s leads to a superconductor, width of the transition is then lower than 0.15K. (16 refs.)

119788 Upper critical fields of regular superconductive networks. Surfaces and impurities. J.M.Simonin, C.Wiecko, A.Lopez (Centro Atomico Bariloche, Comision Nacional de Energia Atomica, Bariloche, Argentina).
Phys. Rev. B (USA), vol.28, no.5, p.2497-504 (1 Sept. 1983).
The upper critical field of several defect structures is studied using the de Gennes-Alexander theory of superconductive networks. The systems considered include a terminated ladder, an impurity site within the ladder, and a square lattice with a surface. Localised modes of condensation appear in all the structures considered. Four different methods have been used alternatively or concurrently: direct diagonalisation, continuous-fraction expansion, transfer matrix, and a renormalisation-group decimation procedure. This last method has proved very useful to study irrational values of the ratio flux to flux quantum in the square lattice. The case of the square lattice with a surface shows several characteristics in common with surface superconductivity (H_{c3}) in bulk materials. (9 refs.)

119789 Mixed state of the layered metals. B.Ya.Shapiro (Inst. of Inorganic Chem., Acad. of Sci., Novosibirsk, USSR).
Solid State Commun. (USA), vol.48, no.4, p.365-7 (Oct. 1983).
The theory of mixed state of the layered metals is presented. It is shown that the lattices of the superconductive states localized along the magnetic field arise in the layered metals systems. The magnetic moment, structure and energy of the lattices of the superconductive states are determined. (16 refs.)

The c-axis interaction in $(TMTSF)_2X$ .... See Entry 119401

The Bechgaard phase, asymmetric anions and $T_c > 3K$ .... See Entry 119738

Conduction properties of $ZrTe_3$ .... See Entry 119746

Low field ESR in the superconducting relaxed state of $(TMTSF)_2ClO_4$ at low temperature .... See Entry 119756

Anisotropy of the Meissner effect and the diamagnetic shielding in $(TMTSF)_2ClO_4$ .... See Entry 119759

Superconductivity and anomalous magnetotransport in $(TMTSF)_2ClO_4$ .... See Entry 119768

74.60G Flux pinning; fluxon-defect interactions

119790 Quasiclassical theory of the elementary pinning potential of a vortex line to a small defect in a type II superconductor. J.Kurkijarvi, D.Rainer, E.V.Thuneberg.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.86-9 (1983).
Flux pinning is studied by the quasiclassical method. The authors give results on a quasiparticle scattering mechanism of elementary pinning which outweighs the traditional excluded volume effect by the factor coherence length divided by the spatial extent of the pinning center. (10 refs.)

119791 Fluxoid motion and electromagnetic phenomena of a superconductor in a longitudinal magnetic field. T.Matsushita, Y.Hasegawa, J.Miyake (Dept. of Electronics, Kyushu Univ., Fukuoka, Japan).
J. Appl. Phys. (USA), vol.54, no.9, p.5277-81 (Sept. 1983).
The fluxoid motion during the process of applying the transport current to a superconductor in the longitudinal field configuration is visualized by solving the continuity equation of the fluxoid number. In this configuration, the force-free state described by rot $\mathbf{B}=\alpha\mathbf{B}$ is assumed. The obtained fluxoid velocity $\mathbf{v}$ contains the torsionally shearing component. The well-known relation $\mathbf{E}=\mathbf{B}\times\mathbf{v}$ does not hold in the present field configuration. This fluxoid motion and the related phenomena are compared with those in the rotating transverse field configuration. (16 refs.)

119792 Computer simulation of vortex pinning in type II superconductors. I. Two-dimensional simulation. E.H.Brandt (Inst. fur Phys., Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany).
J. Low Temp. Phys. (USA), vol.53, no.1-2, p.41-70 (Oct. 1983).
The summation of pinning forces to a volume exerted on the vortex lattice in type II superconductors allowing it to carry a loss-free current is not fully understood. In order to clarify this question the author started computer simulations of flux pinning. It is shown that for many experimental situations bending of vortices may be neglected since the vortices are too short or pinning is too weak, and thus pinning is two-dimensional. As a first step, two-dimensional pinning simulations will thus be instructive with regard to, say, ribbons of amorphous metals. A general expression for the energy of a vortex-pin system in two and three dimensions is given. The simulation method is presented and illustrated for the isolated pin (with a detailed discussion of the 'threshold effect' and of elastic instabilities) and for pin 'walls' (grain boundaries) and 'nozzles'. (52 refs.)

119793 Computer simulation of vortex pinning in type II superconductors. II. Random point pins. E.H.Brandt (Inst. fur Phys., Max-Plank-Inst. fur Metallforschung, Stuttgart, Germany).
J. Low Temp. Phys. (USA), vol.53, no.1-2, p.71-152 (Oct. 1983).
For pt.I see ibid., vol.53, nos.1/2, p.41 (1983). Pinning of vortices in a type II superconductor by randomly positioned identical point pins is simulated using the two-dimensional method. The system is characterized by the vortex and pin numbers (N_v,N_p), the vortex and pin interaction ranges (R_v, R_p), and the amplitude of the pin potential A_p. The computation is performed for many cases: dilute or dense, sharp or soft, attractive or repulsive, weak or strong pins, and ideal or amorphous vortex lattice. The total pinning force F as a function of the mean vortex displacement X increases first linearly (over a distance usually much smaller than the vortex spacing and than R_p) and then saturates, fluctuating about its average $\bar{F}$. $\bar{F}$ is interpreted as the maximum pinning force j_cB of a large specimen. For weak pins the prediction of Larkin and Ovchinnikov (1979) for two-dimensional collective pinnings is confirmed: $\bar{F}=$ const.$\bar{W}/R_pc_{66}$, where $\bar{W}$ is the mean square pinning force and c_{66} is the shear modulus of the vortex lattice. If the initial vortex lattice is chosen highly defective ('amorphous') the constant is 1.3-3 times larger than for the ideal triangular lattice. This finding may explain the often observed 'history effect'. The function $\bar{F}(A_p)$ exhibits a jump, which for dilute, sharp, attractive pins occurs close to the 'threshold value' predicted for isolated pins by Labusch (1969). (13 refs.)

119794 Flux-line instability in a superconducting wire with longitudinal current. Z.Przelozny (Inst. of Nuclear Phys., Acad. of Mining & Metall., Krakow, Poland).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.44-6 (3 Oct. 1983).
The vortex lattice in a type II superconducting wire is unstable to the growth of helical deformation if the current along the vortices exceeds a critical value. The critical current is obtained by pinning or by the shear stiffness in a pure sample. The dependence of critical current on the external magnetic field, exhibits a peak in a field close to H_{c2}. (4 refs.)

119795 On the flux jumps in hard superconductors. J.Sosnowski (LMSES CNRS, Inst. de Phys., Univ. Louis Pasteur, Strasbourg, France).
Phys. Status Solidi a (Germany), vol.79, no.1, p.207-12 (Sept. 1983).
The results of the calculations of the higher stability limits appearing after the successive flux jumps are presented. The solutions of the recurrence equations for two kinds of relations between the flux jump field and stability-limited field are given. In the first case, in which all instabilities develop into the flux jumps, the periodicity of the successive flux jumps is predicted, while in the second, in which the flux jump field is proportional to the stability-limit field, the distance between flux jumps is described by geometrical progress. (10 refs.)

119796 Role of grain boundaries in the trapping of a magnetic flux and in the change of plasticity during a superconducting-normal transition. V.V.Pustovalov, V.A.Sirenko, V.S.Fomenko (Physicotech. Inst. of Low Temperatures, Acad. of Sci., Kharkov, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.496-7 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.867-9 (March 1983). [received: Oct. 1983]
The authors have investigated the change in the trapped magnetic flux B_0 with the deformation of single-crystal and polycrystalline Pb-In alloys in a wide range of indium concentrations (0-30 at.% In). The same experiments established the influence of grain boundaries on the change in the plasticity as a result of the superconducting-normal transition, which was important for the understanding of the nature of such changes. (3 refs.)

Flux trapping in Josephson tunnel junctions .... See Entry 119773

74.60J Critical currents

119797 The mounting of samples of filamentary A15 superconductor for J_c tests. H.Jones (Univ. of Oxford, Oxford, England), P.A.Hudson, Y.S.Hascicek, S.Nourbakhsh, M.J.Goringe.
Cryogenics (GB), vol.23, no.10, p.557-9 (Oct. 1983).
The authors describe a technique for mounting samples of filamentary A15 superconducting materials which give reliable results in J_c tests. They discuss the possible disadvantages of the method and how these are overcome. (12 refs.)

Flux-line instability in a superconducting wire with longitudinal current .... See Entry 119794

74.70 SUPERCONDUCTING MATERIALS

On the flux jumps in hard superconductors .... See Entry 119795

Theory of far-infrared absorption in superconducting composites .... See Entry 120084

74.70D Material effects on T_c, K, critical currents

(see also 81.40R Electrical properties related to materials treatment)

Instabilities in the superconductivity and the resistivity of implanted $Pd_{1-y}Cu_yH_x$ thin layers .... See Entry 119751

74.70L Type-II superconductors (transition metals, alloys and compounds)

Influence of the disorder potential of the anions on the ground state of the organic alloy $(TMTSF)_2(ClO_4)_{1-x}(ReO_4)_x$ .... See Entry 118994

Hydrogen bond formation and anion ordering in superconducting $(TMTSF)_2ClO_4$ and $(TMTSF)_2AsF_6$ .... See Entry 119003

Atomic configurations of interstitials in intermetallic compound Nb_3Sn .... See Entry 119013

Structural phase transition in the Chevrel-phase $Ag_{1.6}Mo_6S_8$ .... See Entry 119172

The c-axis interaction in $(TMTSF)_2X$ .... See Entry 119401

Fermi-surface nesting, closed orbits, and the 'threshold field' in an organic superconductor .... See Entry 119405

Theory of anion ordering in TMTSF compounds .... See Entry 119438

The Bechgaard salts: magnetotransport, dimensionality, spin density waves and the threshold field .... See Entry 119563

Low temperature transport measurements on $(TMTSF)_2ClO_4$ .... See Entry 119565

Cooperative phenomenon in ternary superconductors .... See Entry 119737

The Bechgaard phase, asymmetric anions and $T_c > 3K$ .... See Entry 119738

Organic superconductors: three years only! .... See Entry 119739

A sulphur based organic molecular superconductor: $(BEDT\text{-}TTF)_4(ReO_4)_2$ .... See Entry 119740

Superconductivity and metal-nonmetal transitions in $(TMTSF)_2ClO_4$ .... See Entry 119741

Transport properties under pressure of the organic conductors $(TMTTF)_2X$; $X=PF_6$, ClO_4, Br .... See Entry 119742

Coexistence of superconductivity and spin density waves: $(TMTSF)_2X$ .... See Entry 119743

Correlation between superconductivity and charge-density-waves in $Nb_{1-x}Ta_xSe_3$ .... See Entry 119744

Third-harmonic susceptibility $|\chi_3|$ of quasi-one-dimensional superconductors Nb_3S_4, Nb_3Se_4, and Nb_3Te_4 .... See Entry 119745

Conduction properties of $ZrTe_3$ .... See Entry 119746

The effect of atomic order on the superconducting properties of A-15 Nb_3Au and $Nb_3Au_{1-x}Pt_x$ alloys .... See Entry 119749

Instabilities in the superconductivity and the resistivity of implanted $Pd_{1-y}Cu_yH_x$ thin layers .... See Entry 119751

Low field ESR in the superconducting relaxed state of $(TMTSF)_2ClO_4$ at low temperature .... See Entry 119756

High field magnetoresistance measurements of $(TMTSF)_2ClO_4$ .... See Entry 119757

Magnetoresistance of $(TMTSF)_2ClO_4$ .... See Entry 119758

Anisotropy of the Meissner effect and the diamagnetic shielding in $(TMTSF)_2ClO_4$ .... See Entry 119759

Diamagnetic anisotropy, isotope shift and cooling-speed effects in superconducting $(TMTSF)_2ClO_4$ crystals .... See Entry 119760

Quenched and relaxed low temperature states in $(TMTSF)_2ClO_4$ .... See Entry 119761

The magnetic field dependence of the specific heat in $(TMTSF)_2ClO_4$ .... See Entry 119762

Characteristics of the specific heat of superconducting Laves phases ZrV_2 and HfV_2 .... See Entry 119763

Quantum oscillations of the ultrasound attenuation in bismuth .... See Entry 119764

A magnetic state in the organic superconductor $(TMTSF)_2ClO_4$: cooling rate and strong magnetic field effects .... See Entry 119765

Superconductivity and anomalous magnetotransport in $(TMTSF)_2ClO_4$ .... See Entry 119768

Lifetime broadening effects in normal and superconducting states of A-15 materials .... See Entry 119772

Tunneling in organic superconductors .... See Entry 119775

Ultrasonic study of niobium in longitudinal magnetic fields .... See Entry 119784

Magnetoresistance and critical field measurements on the magnetic superconductor Y_4Co_3 .... See Entry 119786

Superconductivity? .... See Entry 119787

The mounting of samples of filamentary A15 superconductor for J_c tests .... See Entry 119797

Physical properties of the TMTTF salts and TMTSF/TMTTF alloys: competition between the stacks instabilities .... See Entry 119810

Local environment effects on the magnetic state of Fe in amorphous $Cu_{0.6}Zr_{0.4-x}Fe_x$ alloys .... See Entry 119853

Far infrared properties of $(TMTSF)_2ClO_4$ .... See Entry 120069

74.70N Dirty superconductors

Magnetoresistance and critical field measurements on the magnetic superconductor Y_4Co_3 .... See Entry 119786

74.70P Materials for high-field applications

Normal zone propagation within a superconducting magnetic system and cryostabilization of superconductivity .... See Entry 119767

75.00 MAGNETIC PROPERTIES AND MATERIALS

(see also 81.40R Magnetic properties related to materials treatment; for galvanomagnetic effects, see 72.15G and 72.20M; for magneto-optical effects, see 78.20L)

75.10 GENERAL THEORY AND MODELS OF MAGNETIC ORDERING

(see also 05.50 Ising problems, 71.25 Nonlocalized single-particle electronic states, 71.70 Level splitting and interactions)

119798 Magnetism of the heavy 5f elements. P.G.Huray, S.E.Nave (Dept. of Phys., Univ. of Tennessee, Knoxville, TN, USA), R.G.Haire.
J. Less-Common Met. (Switzerland), vol.93, no.2, p.293-300 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
Magnetic properties of the trivalent lanthanide ions have been classically used to demonstrate the applicability of L-S coupling and Hund's rule to the 4f element series. An examination of similar behavior for the more spatially extended orbitals of the 5f element series has, until the last few years, been limited to lighter members (actinium through americium). Characterization of magnetic properties of heavier ions (curium, berkelium, californium and einsteinium) has recently led to a comparison with the 4f ion homologues of the actinides and to an extension of the test of L-S coupling to a new region of the periodic table. Investigations of the magnetic properties of heavy element compounds and metals have additionally led to some unexpected results which suggest a rich structure of low temperature magnetic ordering. The increasing degree of spatial localization of the heavy actinide orbitals thereby provides another vehicle for studying the theory of magnetic ordering via the conduction electrons. (16 refs.)

Onset of rare earth behavior in the actinides .... See Entry 119498

75.10D Crystal-field theory and spin Hamiltonians

Magnetic properties of actinide elements having the $5f^6$ and $5f^7$ electronic configurations .... See Entry 119813

75.10H Ising and other classical spin models

119799 A Monte Carlo study of the three-states antiferromagnetic Potts model in two dimensions. F.Fucito (California Inst. of Technol., Pasadena, CA, USA).
J. Phys. A (GB), vol.16, no.14, p.L541-5 (1 Oct. 1983).
Using Monte Carlo methods the author studies the two-dimensional three-stages Potts model with antiferromagnetic nearest neighbours and ferromagnetic next-nearest neighbours couplings on a square lattice. The author focuses on the case with only antiferromagnetic coupling; from the analysis of the data gathered, there is evidence that this system shows critical behaviour only at $T=0$. (10 refs.)

119800 Diffusion coefficients of fluctuations in semi-infinite ferromagnets. W.Korneta (Dept. of Phys., Tech. Univ., Radom, Poland), Z.Pytel.
J. Phys. Lett. (France), vol.44, no.19, p.L811-16 (1 Oct. 1983).
The nearest-neighbour Ising model of a semi-infinite ferromagnet in which near-surface couplings may differ from their bulk values is considered. In the critical region near second-order phase transitions the decay of fluctuations of the magnetization density is described by a diffusion equation with a damping term. Using mean-field theory, the diffusion coefficients of fluctuations in the paramagnetic phase near the ordinary, surface-bulk and surface phase transitions are obtained and their dependence on the distance from the surface of the ferromagnet and on the temperature is discussed. (10 refs.)

119801 Digital dynamics and the simulation of magnetic systems. M.Y.Chaoi (Dept. of Appl. Phys., Stanford Univ., Stanford, CA, USA), B.A.Huberman.
Phys. Rev. B (USA), vol.28, no.5, p.2547-54 (1 Sept. 1983).
This paper investigates the problems associated with simulating many-body systems with finite-state machines such as computers. It is shown that the digital (discrete) character of time brings in features which are not encountered in the usual analytical studies using continuous time. This is illustrated with a thorough study of the dynamics of simple magnetic systems with competing interactions. Whereas continuous dynamics, as derived from the usual master-equation approach, yields asymptotic behaviour which is time independent, dynamics in digital time can led to complex behaviour characterized by the existence of multiple basins of attraction, broken symmetries, oscillations, and chaos. These results might provide a dynamical explanation for the breakdown of erogodicity which has been reported in Monte Carlo studies of spin-glasses. (23 refs.)

119802 Surface tension, roughening, and lower critical dimension in the random-field Ising model. G.Grinstein (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), Shang-keng Ma.
Phys. Rev. B (USA), vol.28, no.5, p.2588-601 (1 Sept. 1983).
A continuum intertace model is constructed to study the low-temperature properties of domain walls in the random-field Ising model (RFIM). The width of the domain wall and its surface tension are computed by three methods: simple energy accounting, dimensional arguments, and approximate renormalization-group calculations. All methods yield a surface tension which is positive at sufficiently low temperature for small random fields, h, provided that the dimensionality $d>2$. The lower critical dimension of the RFIM is thus argued to be 2. While effects due to discreteness of a lattice are argued to alter some of the continuum results quantitatively, they do not change these central conclusions. For $d<2$ the ferromagnetic correlation length of the RFIM behaves like $1/(h^{-2(-d)})$ as $h \rightarrow 0$. (35 refs.)

2D pure and dilute quantum transverse Ising model .... See Entry 117107

Competing criticality of short- and infinite-range interactions on the Cayley tree .... See Entry 117111

75.10J Heisenberg and other quantized localized spin models

2D pure and dilute quantum transverse Ising model .... See Entry 117107

75.10L Band and itinerant models

119803 Magnetic doublet states in quasi-1D tetracyanoquinodimethanides. L.Komorowski (Inst. of Organic & Phys. Chem., Tech. Univ. of Wroclaw, Wroclaw, Poland).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1593-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
A singlet-doublet-triplet model (SDT) has been proposed for the spin distribution in a quasi-1d chain of a complex ion-radical salt of TCNQ. Isolated $TCNQ^-$ radicals frozen within the chain by cooling have been identified as 'radical impurities' imminently present in these materials. (6 refs.)

119804 Correlation effects in band ferromagnets as detected by energy-and angle-resolved spin-polarized photoemission: Ni(110). R.Clauberg (Inst. fur Festkorperforschung, KFA, Julich GmbH, Julich, Germany).
Phys. Rev. B (USA), vol.28, no.5, p.2561-5 (1 Sept. 1983).
Calculated spectra of photoemission from Ni(110) with the use of a single-step model of the photoemission process and with the inclusion of self-energy corrections within the *t*-matrix approximation are compared to the results of a recent energy-, angle- and spin-resolved photoemssion experiment with linearly polarized light ($h\nu=16.85$ eV). The power of this technique to study electronic structure of correlated, magnetic solids is for the first time fully exploited. Good agreement is found not only in peak positions, but also in relative intensities as well as line shapes. In addition, evidence is provided that surface relaxation is important for the full understanding of the electronic structure of this particular crystal surface. (21 refs.)

Calculations of the electronic ($4k_F$) and magnetic ($2k_F$) phase transitions from a Hubbard Hamiltonian with an exponentially dependent intersite-transfer integral .... See Entry 119382

Magnetic properties of actinide elements having the $5f^6$ and $5f^7$ electronic configurations .... See Entry 119813

75.20 DIAMAGNETISM AND PARAMAGNETISM

119805 The valency state of Ce in liquid Ni-Ce-alloys. V.M.Solodovnikov, V.V.Singer, I.Z.Radovskii, P.V.Geld.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1375-9 (Sept. 1983). In Russian.
Measurements of the magnetic susceptibility χ, electrical resistivity ρ and calculation of ρ were used to determine the concentration dependence of Ce valency in liquid Ni-Ce-alloys. (12 refs.)

Many body theory of intermediate valence systems ....See Entry 119524

Electrical and magnetic properties of poly p-azophenylene ....See Entry 119562

75.20C Nonmetals

119806 **Magnetic susceptibilities and the order parameters of some 4,4′-disubstituted biphenyl cyclohexanes.** H.J.Muller, W.Haase (Inst. fur Phys. Chem., Tech. Hochschule Darmstadt, Darmstadt, Germany).

J. Phys. (France), vol.44, no.10, p.1209-13 (Oct. 1983).

The diamagnetic susceptibilities of some 4,4′-disubstituted biphenyl cyclohexanes are reported as a function of temperature. The order parameters of the uniaxial nematic, smectic A and smectic B phases are calculated. The effect of the terminal substituents and the central groups on the magnetic anisotropy and the order parameter is discussed. (21 refs.)

119807 **Diamagnetism of dilute acceptor compounds of graphite.** K.Matsubara, K.Kawamura, T.Tsuzuku (Coll. of Sci. & Technol., Nihon Univ., Tokyo, Japan).

J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3180-7 (Sept. 1983).

Diagmagnetism study on graphite-acceptor compounds has been further extended over dilute nitrates and slightly neutron-irradiated graphite. An analysis was made on the basis of Sharma-Johnson-McClure's theory taking into account the trigonal warping of the Fermi surface. The susceptibility vs. reciprocal temperature plots, including those for IC*l* compounds not completely interpreted in the previous study, have been theoretically reproduced by assuming a mixed phase structure of orderly intercalated and purely graphitic domains in each sample. The hole production rate (ionization efficiency) of acceptors was evaluated by using Ono-Sugihara's formulae which takes into account the trigonal warping effect on the carrier density. It has been found that 5% of intercalated IC*l* is ionized in the doped regions irrespectively of the total content. (18 refs.)

119808 **Magnetic susceptibility of tetravalent curium compounds.** S.E.Nave (Dept. of Phys. & Aston., Univ. of Tennessee, Knoxville, TN, USA), R.G.Haire, P.G.Huray.

J. Less-Common Met. (Switzerland), vol.93, no.2, p.360 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).

Summary form only given, as follows. A systematic magnetic study was carried out on the nominally $(5f)^6$ electronic configuration for curium in the compounds CmO_2, CmF_4, $BaCmO_3$ and $(Th,Cm)O_2$. The f^6 electronic configuration is predicted to have a zero paramagnetic effective moment by both simple *L-S* coupling and intermediate coupling models. However, the smallest moment that has been observed is 1.6 μ_B and was obtained for the oxide compounds CmO_2 and $BaCmO_3$. The moment appears to be dependent on the compound, with an even larger value for CmF_4. In all cases the non-zero moments are too large to be attributed to impurity content as ascertained by standard analytic techniques. The $(5f)^7$ configuration of trivalent curium has a moment measured to be very near that of 7.92 μ_B predicted by simple *L-S* coupling. This moment is so large that only about 4 at.% present in these nominally tetravalent compounds would give rise to the observed moment of 1.6 μ_B. Owing to the potential presence of trivalent curium, special attention has been given to minimizing its presence in the preparation of samples, to analytical techniques for detecting it and to assessment of its effect on the magnetic data. The $BaCmO_3$ compound was studied on the premise that it afforded maximum stabilization of the tetravalent state of curium. The study was also extended to curium doped (about 3 mol.%) into a ThO_2 matrix. This gave a non-magnetic matrix in which to observe the tetravalent state and served to determine the effect of Cm-Cm interactions. The lowest moment measured for a $(Th,Cm)O_2$ was 4 μ_B.

119809 **Magnetic behavior of Dy^{3+} ion in $Dy_2(SeO_4)_3.8H_2O$. Experimental and theoretical study including the effects of *J-J* mixing.** D.Neogy (Dept. of Phys., Burdwan Univ., Burdwan, India), J.Nandi.

J. Phys. & Chem. Solids (GB), vol.44, no.10, p.943-9 (1983).

Single crystals of dysprosium selenate octahydrate were grown and magnetic measurements carried out on the principal anisotropies and the principal susceptibility χ_1 at room temperature and their thermal variation down to 90K. The magnetic moment is found to be slightly lower than the free-ion value, although the anisotropy is quite high. The variation of the average moment with temperature is very small and a least squares fit to a Curie-Weiss law yielded -0.97K as the paramagnetic Curie temperature. An analysis of the data was undertaken on the basis of interaction of the rare ion with its immediate neighbors. A crystal field (CF) of tetragonal symmetry which is the approximate site symmetry of the RE^{3+} ion, gave an excellent simulation of the observed behavior. Considerable effects of *J-J* mixing of the first three *J*-multiplets with the ground one were noticed. *g*-factors and the Schottky anomalies in the heat capacity were determined theoretically. Various hyperfine properties, including the thermal variation of the Mossbauer spectra, were computed for both isotopes of dysprosium in the light of the proposed CF. (26 refs.)

119810 **Physical properties of the TMTTF salts and TMTSF/TMTTF alloys: competition between the stacks instabilities.** C.Coulon (Domaine Univ., Talence, France).

J. Phys. Colloq. (France), vol.44, no.C-3, p.885-92 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

The physical properties of the $(TMTTF)_2$ X salts and $[(TMTSF)_{1-x}(TMTTF)_x]_2ClO_4$ alloys are reviewed. The nature of the low temperature phase transitions is discussed in connection with the electronic properties at higher temperature and for $(TMTTF)_2$ SCN with the anion ordering. (21 refs.)

119811 **Magnetic sub-chain anisotropy in the crossing chain compound $HMM(TCNQ)_2$.** S.Oostra, R.J.J.Visser, G.A.Sawatzky (Lab. of Phys. Chem., Univ. of Groningen, Groningen, Netherlands), C.F.Schwerdtfeger.

J. Phys. Colloq. (France), vol.44, no.C-3, p.1381-2 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

$HMM(TCNQ)_2$ is a compound with non-parallel TCNQ chains. Although the chains are identical this leads to very different susceptibilities for the non-parallel chains as observed by ESR, depending on their angle with respect to the direction of magnetic field. (3 refs.)

119812 **Magnetic susceptibility of the one-dimensional metal $Li_xPt(C_2S_2(CN)_2)_2$, $2H_2O$.** J.R.Cooper, M.Miljak, M.M.Ahmad, A.E.Underhill (Inst. of Phys. Univ., of Zagreb, Zagreb, Yugoslavia).

J. Phys. Colloq. (France), vol.44, no.C-3, p.1391-5 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).

Static susceptibility measurements are reported for the one-dimensional metal $Li_xPt(C_2S_2(CN)_2)_2$ from 2 to 300K. By comparing the present results with optical reflectivity data and conductivity data obtained by other groups it is concluded that the electron-electron Coulomb repulsion is small in this material. (12 refs.)

119813 **Magnetic properties of actinide elements having the $5f^6$ and $5f^7$ electronic configurations.** S.E.Nave (Dept. of Phys., Univ. of Tennessee, Knoxville, TN, USA), R.G.Haire, P.G.Huray.

Phys. Rev. B (USA), vol.28, no.5, p.2317-27 (1 Sept. 1983).

Magnetic susceptibility measurements have been made on multimicrogram quantities of $^{243}AmF_3$, $^{248}CmF_4$, $^{248}CmO_2$ and $^{248}CmBaO_3$ samples (nominally the $5f^6$ electronic configuration) and on $^{248}Cm_2O_3$, $^{248}CmF_3$, $^{249}BkF_4$ and $^{249}BkO_2$ (nominally the $5f^7$ electronic configuration) in the temperature range 4.2-300K and in magnetic fields up to 1650 G. The experimentally determined effective magnetic moments and the Curie-Weiss constants for these compounds are presented. The deviation of the moments for the $5f^6$ compounds from those expected from classic theory is discussed in terms of low-lying excited states, chemical composition, crystal-field perturbations and realistic electronic structure. (29 refs.)

119814 **Magnetic and thermal behavior of $NiSnCl_6.6H_2O$ at low temperatures.** D.L.Meier, M.Karnezos, S.A.Friedberg (Dept. of Phys., Carnegie-Mellon Univ., Pittsburgh, PA, USA).

Phys. Rev. B (USA), vol.28, no.5, p.2668-76 (1 Sept. 1983).

$NiSnCl_6.6H_2O$ crystals have a trigonal structure containing one trigonally distorted $[Ni(H_2O)_6]^{2+}$ complex per unit cell. The authors have measured the magnetic susceptibilities $\chi_\parallel$ and $\chi_\perp$ and the heat capacity *Cp* of single-crystal specimens of this salt down to ~0.06K in a ^3He-^4He dilution refrigerator. The low- (zero-) field data are well described by a model in which the $^3A_{2g}$ ground state of $[Ni(H_2O)_6]^{2+}$ is split into a lower singlet separated from an excited doublet by $D/k=0.576$K, and significant antiferromagnetic interionic interactions exist which are too small relative to *D* to produce long-range spin order Using both simple mean-field and Oguchi approximations, they have determined the parameters *D*, $g(=2.24)$, and $zJ/k(=-0.044\text{K})$. Some anisotropy of the subcritical coupling constant, probably of dipolar origin, is inferred from the susceptibility results. Magnetocaloric effect and heat capacity were measured for single crystals with $\hat{H}$ parallel to the trigonal axis. Cooling by adiabatic magnetization, followed by level crossing at $H'_c=4100$ Oe, was observed. However, attempts to observe field-induced long-range spin ordering were not successful. (24 refs.)

A new family of compounds exhibiting the $FeNb_3Se_{10}$ structural type: structural and resistivity measurements ....See Entry 118983

A new series of radical cation salts: the trimethylenetetrathia-fulvalenium pseudo halides salts ($tTTF_2$-X′) ....See Entry 118996

Magnetic, elastic, and thermal properties of Rb_2NaHoF_6 ......See Entry 119188

Characterization of the CDW transition in orthorhombic TaS_3 by thermoelectric power and magnetic susceptibility measurements ....See Entry 119451

Interpretation of the optical and magnetic behaviours of $Pr_2Mg_3(NO_3)_{12}.24H_2O$ ....See Entry 119525

Some properties of $(TMTSF)_2FSO_3$ at low temperature under pressure ....See Entry 119564

Conducting cation-radical salts based on DBTTF and its selenium analogue, DBTSF ....See Entry 119579

Physical properties of a new highly conducting TCNQ salt: $MPht(TCNQ)_2$ ....See Entry 119580

Anisotropy of the Meissner effect and the diamagnetic shielding in $(TMTSF)_2ClO_4$ ....See Entry 119759

Diamagnetic anisotropy, isotope shift and cooling-speed effects in superconducting $(TMTSF)_2ClO_4$ crystals ....See Entry 119760

Magnetic properties of $Cr_{1-x}Fe_xGe$ ....See Entry 119822

Magnetic properties of some morpholinium $(TCNQ)_2$ salts ....See Entry 119825

Magnetic study of the phase transitions in $(TMTTF)_2X$ salts ....See Entry 119839

Electron spin resonance studies of magnetic defects in $FeCl_3$-doped polyparaphenylene $(p\text{-}C_6H_4)x$ ....See Entry 119916

Magnetic susceptibility and ^{19}F nuclear magnetic resonance in nickel trifluoride ....See Entry 119933

Temperature dependence of NMR T_1 and χ in Br_3, AsF_6-doped $(CH)_x$ ....See Entry 119936

The origin of anomalous temperature dependences of intensities of spin-forbidden d-d transitions in octahedral complexes ....See Entry 120110

75.20E Metals and alloys

119815 **Experimental observation of the diamagnetic susceptibility of gold in the temperature range 4-290K.** R.Plumier, M.Sougi, M.Lecomte (Service de Phys. du Solide et de Resonance Magnetique, CENS, Gif-sur-Yvette, France).

J. Phys. & Chem. Solids (GB), vol.44, no.10, p.1015-17 (1983).

High precision measurements of the diamagnetic susceptibility of gold have been performed in the temperature range 4-290K using a Setaram Faraday balance of 10^{-6}g sensitivity. The experiments are performed at four different magnetic field values H_i $(i=1,...4)=5.5$, 7.3, 9 and 10.3 kG. After subtraction of the contribution of the holder to the observed forces. (5 refs.)

119816 **The paramagnetic properties of Heusler alloys containing iron.** P.J.Webster (Dept. of Civil Engng., Univ. of Salford, Salford, England), K.R.A.Ziebeck.

Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.51-3 (3 Oct. 1983).

The paramagnetic properties of the two Heusler alloys Fe_2VAl and Fe_2VGa are shown to be non-Curie-Weiss, but to contain a Van Vleck contribution. Comparisons are made with related Heusler alloy series and current exchange theories. (11 refs.)

Electronic properties of Cu-Ti metallic glasses ....See Entry 119542

Electronic properties of $Ca_{1-x}Al_x$ metallic glasses ....See Entry 119547

Hall effect in Ni-rich $Fe_xNi_{80-x}B_{18}Si_2$ amorphous alloys ......See Entry 119548

The influence of cold-working on magnetic properties in Ni_3Al ......See Entry 119889

75.20H Local moment in dilute alloys; Kondo effect

(see also 72.15Q Electronic conduction)

119817 Temperature-dependent susceptibility for the asymmetric Anderson model. N.Kawakami, A.Okiji (Dept. of Appl. Phys., Osaka Univ., Osaka, Japan).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.54-6 (3 Oct. 1983).
The temperature-dependent impurity susceptibility for the asymmetric Anderson model is calculated with the aid of the Bethe Ansatz method. The results show good agreement with those of the renormalization-group calculations. (11 refs.)

75.25 SPIN ARRANGEMENTS IN MAGNETICALLY ORDERED MATERIALS (NEUTRON STUDIES, ETC)

119818 Theoretical investigations of the dynamical neutron diffraction by magnetic single crystals. H.H.Schmidt (Phys.-Dept., Tech. Univ. Munchen, Garching, Germany).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.679-82 (1 Sept. 1983).
The fundamental equations for dynamical magnetic neutron diffraction including an external magnetic field are given. The reflecting power is calculated for some special cases for asymmetrical Laue geometry. Some Pendellosung effects are discussed. Analytical and numerical results for the integrated reflecting power are presented. (12 refs.)

119819 Experiments on dynamical magnetic neutron diffraction by $DyFeO_3$. H.H.Schmidt, K.Konig, H.Daniel (Phys. Dept., Tech. Univ. Munchen, Garching, Germany).
Acta Crystallogr. Sect. A (Denmark), vol.A39, pt.5, p.682-5 (1 Sept. 1983).
The integrated reflecting powers of two nuclear and one magnetic reflection of a $DyFeO_3$ crystal have been measured. The results indicate that dynamical magnetic diffraction occurs. In addition, the integrated reflecting power of the magnetic reflection was measured as a function of the magnetic field applied to the crystal. The results are discussed. (12 refs.)

119820 Neutron-scattering study of the randomly mixed antiferromagnet with competing anisotropies $K_2Co_xFe_{1-x}F_4$. W.A.H.M.Vlak (Netherlands Energy Res. Found. ECN, Petten, Netherlands), A.F.M.Arts, H.W.de Wijn.
J. Phys. C (GB), vol.16, no.28, p.L1015-20 (10 Oct. 1983).
The phase diagram of the two-dimensional (2D) randomly mixed antiferromagnet with orthogonal competing anisotropies $K_2Co_xFe_{1-x}F_4$ has been examined with elastic neutron scattering, in particular for $x=0.27$. For this composition the system supports long-range order of the axial spin components in 3D below a regular second-order transition at $T_N=64.4\pm0.6$K. The transverse components also order below T_N, but in 2D and over limited distances only. Below $T_L=27\pm2$K the transverse components acquire 3D order by reorientation, establishing an oblique antiferromagnetic phase in four domains. The lower transition is first order. (18 refs.)

119821 Magnetic, chemical and structural ordering in transition metals. V.Heine, J.H.Samson (Cavendish Lab., Univ. of Cambridge, Cambridge, England).
J. Phys. F (GB), vol.13, no.10, p.2155-68 (Oct. 1983).
The metals in the middle of the transition metal series have a tendency towards antiferromagnetism, ordered AB alloy structures and lattice distortions based on a twofold superlattice. By contrast, at the beginning and end of the series the corresponding tendency is towards ferromagnetism, chemical segregation rather than alloy formation, and stable simple structures. The authors show how all these results can be understood in a unified way in terms of a general theorem published earlier. The argument applies quite generally to any set of tight-binding bands such as the d bands, independent of the specific structure. In a general sense the superlattice formation for approximately a half-filled band is like a Peierls transition, but it results from the electronic structure as a whole with no special role attached to the Fermi surface. The case of threefold superlattices is also discussed with examples. (39 refs.)

Physical interpretation of weak localization: a time-of-flight experiment with conduction electrons ......See Entry 119717

Anisotropy and exchange effects in heavy rare-earth-cobalt compounds of the RCo_5 type ......See Entry 119832

A magnetic phase transition in UNi_2Si_2 ......See Entry 119845

Cascade of orientational phase transitions in substituted thulium orthoferrite ......See Entry 119858

75.30 MAGNETICALLY ORDERED MATERIALS, OTHER INTRINSIC PROPERTIES

(for critical point effects, see 75.40)

75.30C Saturation moments and magnetic susceptibility

119822 Magnetic properties of $Cr_{1-x}Fe_xGe$. T.Sato, E.Ohta, M.Sakata (Dept. of Instrumentation Engng., Keio Univ., Yokohama, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3163-9 (Sept. 1983).
The magnetic susceptibility χ and the electrical resistivity ρ of $Cr_{1-x}Fe_xGe$ ($0\leq x\leq0.9$) are measured in the temperature ranges of 4.2-420K and 4.2-300K, respectively. The magnetic susceptibility shows the Curie-Weiss-like behavior in a composition region close to a critical composition for the onset of ferromagnetism ($x=0.75$). At high temperatures, the electrical resistivity shows a temperature dependence which is convex to temperature axis and finally tends to saturation for all the samples investigated. For small x, the electrical resistivity is proportional to T^2 at low temperatures. These behaviors of χ and ρ for $x>0$ are explained on the basis of the spin fluctuation theory for weakly and nearly ferromagnetic metals. The authors conclude that the degree of the electron correlation increases systematically with increasing x. (21 refs.)

119823 High-pressure synthesis and magnetic properties of the solid solution $MnCr_xSb$ and $CrMn_ySb$ ($0\leq x$, $y\leq1.0$). Y.Noda, M.Shimada, M.Koizumi (Inst. of Sci. & Industrial Res., Osaka Univ., Osaka, Japan).
J. Solid State Chem. (USA), vol.49, no.2, p.215-18 (Sept. 1983).
The full solid solutions of $MnCr_xSb$ and $CrMn_ySb$ ($0\leq x$, $y\leq1.0$) were synthesized under high temperature-pressure conditons. Products were identified by X-ray diffraction. Lattice constants were determined by a least-squares method from high-angle powder patterns. Magnetic measurement were performed using a magnetic torsion balance in the temperature range of 80-873K. (15 refs.)

119824 Susceptibility anisotropy in TMTTF salts. A.Maaroufi, S.Flandrois, C.Coulon, P.Delhaes (Centre de Recherche Paul Pascal, Domaine Univ. de Bordeaux I, Talence, France), J.P.Morand, G.Fillion.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1091-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The anisotropy of static magnetic susceptibility of several TMTTF salts is investigated by torque and SQUID measurements. Some salts become antiferromagnetic at low temperature (bromide, thiocyanate), whereas others have a non-magnetic ground state (perchlorate, hexafluorophosphate). (10 refs.)

119825 Magnetic properties of some morpholinium $(TCNQ)_2$ salts. S.Oostra, J.De Boer, P.De Lange (Labs. of Phys. Chem. & Chem. Phys., Univ. of Groningen, Groningen, Netherlands).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1387-9 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The magnetic susceptibilities of several substituted morpholinium $(TCNQ)_2$ salts has been measured. The results are discussed in relation to the electrical conduction properties. (14 refs.)

119826 Effect of ageing heat treatment on the magnetic behaviour of a gold-iron alloy. P.A.Beck (Univ. of Illinois, Urbana, IL, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2516-21 (1 Sept. 1983).
Susceptibility and magnetisation measurements at temperatures below 200K indicate the absence of long-range ferromagnetic spin order in $Au_{82}Fe_{18}$, aged at 200°C, in spite of a considerable increase of the internal susceptibility as a result of the ageing treatment. (16 refs.)

Cooperative phenomenon in ternary superconductors ......See Entry 119737

Reversibility of phase transition of antiferromagnetic $CoCl_2.6H_2O$ under hydrostatic pressure ......See Entry 119836

Origin of antiferromagnetic ordering in Bechgaard salts ......See Entry 119838

Magnetic study of the phase transitions in $(TMTTF)_2X$ salts ......See Entry 119839

A magnetic phase transition in UNi_2Si_2 ......See Entry 119845

The dynamical susceptibility of metallic spin glass compound $(Ti_{1-x}V_x)_2O_3$: frequency and field dependences ......See Entry 119849

Spin glass-like behaviour in the 1D mixed compound CHAC:Mn ......See Entry 119851

Local environment effects on the magnetic state of Fe in amorphous $Cu_{0.6}Zr_{0.4-x}Fe_x$ alloys ......See Entry 119853

Random-field critical behaviour of a $d=3$ Ising system ......See Entry 119863

Magnetic and Mossbauer studies of some mixed cobaltites of the lanthanides and alkali metals ......See Entry 119872

Magnetism in Eu-based amorphous alloys from local and bulk investigations ......See Entry 119956

Atomic structure and magnetic properties of the pseudobinary alloys $Fe_3(Al, Si)$ ......See Entry 119963

Dielectric, pyroelectric, and magnetic properties of $BiMn_2O_5$ crystals ......See Entry 119989

75.30D Spin waves

(see also 76.50 Spin wave resonance)

119827 Calculation of the energy dissipated by slow monopoles into spinwaves. E.Tarnow.
Phys. Lett. B (Netherlands), vol.129B, no.5, p.307-9 (29 Sept. 1983).
The energy dissipated by slow monopoles into spinwaves is calculated for a ferromagnetically ordered material. (3 refs.)

119828 Magnetic excitations in the triangular spin structure of singlet-ground-state hexagonal antiferromagnet $RbFeCl_3$. N.Suzuki (Dept. of Material Phys., Osaka Univ., Toyonaka, Japan).
Solid State Commun. (USA), vol.48, no.2, p.121-3 (Oct. 1983).
The magnetic excitations observed by Petitgrand et al. (1981) in the ordered state of $RbFeCl_3$ are analyzed and understood quantitatively within the triangular spin structure model by using the dynamical correlated-effective-field approximation. It is pointed out that the singlet-ground-state character (single-ion anisotropy energy of the easy-plane type) has to be correctly taken into account to understand the magnetic excitations of $RbFeCl_3$. (18 refs.)

119829 Magnetoacoustic excitation of coherent spin waves in antiferromagnets. V.L.Preobrazhenskii (Inst. of Radio Engng., Electronics & Automation, Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.517-18 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.899-901 (March 1983). [received: Oct. 1983]
The author discusses a new type of nonlinear excitation of spin waves based on a special very strong magnon-phonon interaction in antiferromagnets with an easy-plane anisotropy. (8 refs.)

The theory of magnetic polarons in antiferromagnetic semiconductors ......See Entry 119478

Solitons in charge and spin density wave systems ......See Entry 119480

The influence of spin-electron interaction on characteristics of current carriers in ferrimagnetic semiconductors ......See Entry 119596

A magnetic phase transition in UNi_2Si_2 ......See Entry 119845

Domain wall mobility in epitaxial iron garnet films ......See Entry 119883

Magnetostatic waves in a magnetic bubble ......See Entry 119885

Spin dynamics and soliton motion in trans-$(CH)_x$ ......See Entry 119893

Electron spin motion in trans-$(CH)_x$ ......See Entry 119895

Magnon fluorescence of Eu-chalcogenides stimulated by intense laser radiation ......See Entry 120146

Transmission of electromagnetic radiation through ferromagnetic metals via oblique magnons? ......See Entry 120192

75.30E Exchange and superexchange interactions

(see also 71.70 Level splitting and interactions)

119830 Magnetic properties of cobalt (II) atoms in solid solutions $Co_xMg_{2-x}GeO_4$. B.Ya.Brach, A.V.Gorelova, N.V.Chezhina.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.101-3 (Aug. 1983). In Russian.
Magnetic properties of solid solutions $Co_xMg_{2-x}GeO_4$ have been investigated. Aggregates of Co atoms characterized by ferromagnetic exchange interactions have been found in diluted solutions. (3 refs.)

A theory for a self-trapped molecular magnetic polaron in ferromagnetic semiconductor ....See Entry 119472

Anisotropy and exchange effects in heavy rare-earth-cobalt compounds of the RCo_5 type ....See Entry 119832

Reversibility of phase transition of antiferromagnetic $CoCl_2.6H_2O$ under hydrostatic pressure ....See Entry 119836

Low-temperature heat capacity of antiferromagnetic ternary rare-earth iron silicides $M_2Fe_3Si_5$ ....See Entry 119855

Interchain interactions in the highly one dimensional tetraethyl ammonium bis(maleonitrile dithiolato) nickelate, NEt_4 Ni mnt_2 ....See Entry 119907

Magnetism in Eu-based amorphous alloys from local and bulk investigations ....See Entry 119956

75.30G Anisotropy

119831 Magnets with random uniaxial anisotropy: thermodynamic properties in the large-N limit. Y.Y.Goldschmidt (Dept. of Phys. & Astron., Univ. of Pittsburgh, Pittsburgh, PA, USA).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B225(FS9), no.1, p.123-44 (3 Oct. 1983).
The author shows that the random-axis model lends itself to a systematic large-N calculation. The model shows different behaviour below and above four dimensions. The equation of state is derived and discussed in terms of 'Arrott' plots. Higher-order terms in the disorder, when summed, have a crucial effect on the susceptibility which is found to be finite below four dimensions (and above four dimensions for strong disorder). A spin-glass to paramagnetic phase transition is characterized by the vanishing of the Edwards-Anderson order parameter, which differs from zero in the spin-glass phase. A cusp in the specific-heat and susceptibility is seen across the transition. The cross-over exponent and other exponents of interest are calculated. Above four dimensions a third phase appears for weak disorder and low-temperature ferromagnetic in nature. The transverse and longitudinal susceptibilities are discussed. Whereas the ferromagnetic to paramagnetic transition is characterized by mean-field exponents, the ferromagnetic to spin-glass exponents are equal to their counterparts in the non-random system in d-2 dimensions. This is shown to originate from an effective random field proportional to the EA order parameter. The flow equations in the large-N limit are also discussed. (21 refs.)

119832 Anisotropy and exchange effects in heavy rare-earth-cobalt compounds of the RCo_5 type. V.V.Kelarev, V.V.Chuev, A.N.Pirogov, S.K.Sidorov (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Phys. Status Solidi a (Germany), vol.79, no.1, p.57-66 (Sept. 1983).
A series of compounds of Co and heavy rare-earth elements of the RCo_5 type (where R=Tb, Dy, Ho) is investigated by the neutron diffraction method in a wide temperature range (from 4.2 to 1050K). The atomic and magnetic structures are investigated. According to the investigations these compounds are collinear ferrimagnetics before as well as after the spin-orientation transition. The data obtained are interpreted in terms of the phenomenological theory of magneto-crystalline anisotropy of the RCo_5 compounds by Irkhin and Rosenfeld (1974). In terms of this theory the anisotropy constants of the R-sublattice (at 0K) and the parameters of intersublattice exchange are obtained. (31 refs.)

119833 Magnetic anisotropy of ion-implanted layers in iron garnet films. V.E.Osukhovskii, D.E.Linkova, V.A.Lenkov, L.A.Tsygel'nyuk, Yu.K.Milyaev, V.I.Mleko (Far-East State Univ., Vladivostok, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.377-9 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.662-6 (March 1983). [received: Oct. 1983]
A study was made of the planar magnetic anisotropy of $(EuTmCa)_3(FeGe)_5O_{12}$ iron garnet films doped by implantation of 50-135 keV H_2^+ ions in doses 1×10^{15} to 7×10^{16} cm^{-2}. The anisotropy was deduced by an analysis of theoretical and experimental torque curves. In the dose range $\phi\leq2.5\times10^{16}$ cm^{-2} the planar anisotropy field H_{ki} was proportional to the dose. At higher doses in the range $\phi>2.5\times10^{16}$ cm^{-3} this anisotropy field decreased on increase in the dose because of partial relaxation of stresses by formation of point-defect complexes. (11 refs.)

Neutron-scattering study of the randomly mixed antiferromagnet with competing anisotropies $K_2Co_xFe_{1-x}F_4$ ....See Entry 119820

Susceptibility anisotropy in TMTTF salts ....See Entry 119824

Reversibility of phase transition of antiferromagnetic $CoCl_2.6H_2O$ under hydrostatic pressure ....See Entry 119836

Mossbauer-effect study of the Morin transition and atomic positions in hematite under pressure ....See Entry 119842

Ferromagnetic resonance study of magnetic anisotropy and domain observations in implanted garnets misoriented from (111) ....See Entry 119882

On the high-energy product Fe-Pt permanent magnet alloys ..See Entry 120455

75.30H Magnetic impurity interactions

119834 Long-range interaction of magnetic impurity states in degenerate semiconductors. Yu.M.Ivanchenko, A.E.Filippov (Physicotech. Inst., Acad. of Sci., Donetsk, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.524-5 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.911-12 (March 1983). [received: Oct. 1983]
There are some semiconductors which have no components with partly filled d or f shells but nevertheless exhibit a ferromagnetic transition at low temperatures. The magnetic behavior is exhibited by this system in a very narrow range of impurity electron densities. The authors state that the monotonic part of the interaction potential is always large for $\epsilon_F\geq\epsilon_l$ (ϵ_p=impurity level) and ferromagnetic ordering is stable in a wide range of densities of the conduction electrons, in complete agreement with the observed behavior of $Pb_{1-x}Sn_xTe$. (3 refs.)

75.30K Magnetic phase boundaries

(inc. magnetic transitions, metamagnetism, etc)

119835 Remarks on phase equilibrium line in (H_xH_z)-diagram of F and CS phase of a metamagnet. W.Prystasz (Inst. for Low Temperatures & Structure Res., Polish Acad. of Sci., Wroclaw, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.3, p.289-93 (Sept. 1983).
It is shown that in the coexistence region of the ferromagnetic F and canted-spin CS phases the equilbirium line of these phases can correspond to the second order phase transition and coincide with the stability boundary for F phase. (2 refs.)

119836 Reversibility of phase transition of antiferromagnetic $CoCl_2.6H_2O$ under hydrostatic pressure. M.Wada, K.Takeda, A.Ohtani, A.Onondera, T.Haseda (Dept. of Material Phys., Osaka Univ., Toyonaka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3188-98 (Sept. 1983).
The hydrostatic pressure dependence of the Neel temperature, magnetic phase diagram and crystal structure of the antiferromagnetic $CoCl_2.6H_2O$ (T_N=2.29K) have been studied by measurements of magnetic heat capacity, susceptibility and X-ray analysis. The anisotropy field $H_A(p)$ and the exchange constant $J(p)$ in the two-dimensional a-b plane have been found to depend linearly on pressure p as $H_A(p)=H_A(p_0)(1+0.24p)$ and $J(p)=J(p_0)(1+0.031p)$ in the range $p_0(\sim0.001$ kbar$)<p<6$ kbar. The Neel temperature $T_N(p)$, however, has been also revealed to depend linearly on p and to be reversible in the process of $p_0\rightleftarrows p$. The appearance of rounding of found irreversible in the process of compression in the critical temperature region $\epsilon(=|T-T_N|T_N)<2\times10^{-2}$. The effect of variation of magnetic dimensionality on the phase transition has been discussed considering the magnetic data and the pressure dependence of atomic or ionic distances in the crystal.

119837 A microscopic theory of the phase transition in $RbFeCl_3$-type hexagonal antiferromagnets: effects of the dipole-dipole interaction. N.Suzuki (Dept. of Material Phys., Osaka Univ., Toyonaka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3199-207 (Sept. 1983).
Effects of the dipole-dipole (DD) interaction on the phase transition in $RbFeCl_3$-type hexagonal antiferromagnets are studied microscopically. The magnetic phase diagram of two typical cases is determined by the molecular-field approximation (MFA): $CsNiF_3$ (DD coupling$\gtrsim$interchain exchange coupling) and $RbFeCl_3$ (DD coupling$\ll$interchain exchange coupling). The authors show that incommensurate (IC) phases are common in these systems. Even in $CsNiF_3$, where no IC phase appears in weak fields, an IC fan structure can appear in the high field region if the magnetic field is applied along a suitable direction. As an attempt to improve the MFA the magnetic phase diagram of $RbFeCl_3$ is determined by making use of the inverse susceptibility tensor calculated by the dynamical correlated-effective-field approximation (DCEFA). (29 refs.)

119838 Origin of antiferromagnetic ordering in Bechgaard salts. J.B.Torrance (IBM Res. Lab., San Jose, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.799-804 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The magnetic data from susceptibility and antiferromagnetic resonance experiments are summarized for the five TMTSF and TMTTF salts known to order antiferromagnetically at low temperature. It is concluded that the magnetic parameters of these compounds differ only by a factor of ~2. There are two possible mechanisms for the origin of his antiferromagnetism: (1) the formation of an Overhauser SDW (low U/4t model); and (2) the three-dimensional ordering of highly correlated electronic spins (high U/4t model). Evidence is given that the latter mechanism is dominant in one of the compounds, and possible in all of them. (21 refs.)

119839 Magnetic study of the phase transitions in $(TMTTF)_2X$ salts. S.S.P.Parkin, J.C.Scott, J.B.Torrance, E.M.Engler (IBM Res. Lab., San Jose, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1111-14 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Antiferromagnetic resonance (AFMR) and single crystal susceptibility studies are presented for $(TMTTF)_2Br$ and $(TMTTF)_2PF_6$. The Br salt displays a magnetic phase transition below 13K, whereas the PF_6 salt exhibits a non-magnetic transition near 15K. The reason for such very different behaviour remains an intriguing question. (14 refs.)

119840 Reentry and coexistence behavior of the magnetic superconductor $(Th_{1-x}Nd_x)Ru_2$. D.Huser, M.J.F.M.Rewiersma, J.A.Mydosh, G.J.Nieuwenhuys (Kamerlingh Onnes Lab., Rijks-Univ. Leiden, Leiden, Netherlands).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1290-2 (3 Oct. 1983).
The authors have measured, via AC susceptibility χ(T,H), the superconducting and magnetic phase diagram for the $(Th_{1-x}Nd_x)Ru_2$ system. For $0.3<x<0.4$ reentry and coexistence behavior are observed at low temperatures. The field-dependent properties show that a weakened superconducting state can exist in a frozen spin-glass or cluster-glass state. Here a field memory effect can esily destroy the superconductivity. This indicates that the spin-glass phase consists of very large randomly frozen ferromagnetic clusters. (19 refs.)

119841 Critical composition of antiferromagnetic ordering in Un_xC_{1-x}. M.Ramaki, H.Matsui, G.Matsumoto, T.Kirihara (Dept. of Nuclear Engng., Nagoya Univ., Nagoya, Japan).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K93-8 (Sept. 1983).
Dilution of antiferromagnetic UN (uranium mononitride) by paramagnetic UC (uranium monocarbide) diminishes the magnetic ordering. The authors have prepared fused and comparatively pure uranium carbonitrides. Precise measurement of the low-temperature electrical resistivity was carried out with a particular emphasis of the critical composition of the antiferromagnetic ordering in U(N, C). (12 refs.)

119842 Mossbauer-effect study of the Morin transition and atomic positions in hematite under pressure. C.L.Bruzzone, R.Ingalls (Dept. of Phys., Univ. of Washington, Seattle, WA, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2430-40 (1 Sept. 1983).
The Mossbauer spectrum of hematite (α-Fe_2O_3) has been investigated over a range of pressures extending to 53 kbar and at temperatures ranging from 77 to 340K. Particular attention has been paid to the effects of the Morin (spin-flip) transition on the ^{57}Fe quadrupole splitting. The anomalous reduction in the quadrupole splitting at points in P-T space near the Morin transition is explained by the application of magnetic anisotropy energy-density arguments, which also yield the mean magnetic-domain size in hematite. From the low-temperature quadrupole-splitting data and knowledge of the pressure dependence of the Morin temperature rather precise information con-

cerning the location of atoms within the unit cell can be extracted. These results are in agreement with the latest high-pressure X-ray diffraction work. In addition, the hyperfine magnetic field is found to increase discontinuously by 1.5% through the pressure-induced Morin transition, similarly to the temperature-induced transition at atmospheric pressure. By taking advantage of recent advances in high-pressure technology and consistently applying the anisotropy energy-density theory of the Morin transition due to Artman, Murphy, and Foner, the authors have explained all of the features of either data, as well as the anomalies in previous work. (38 refs.)

119843 Random fields and three-dimensional Ising models: $Co_xZn_{1-x}F_2$. M.Hagen, R.A.Cowley (Dept. of Phys., Univ. of Edinburgh, Edinburgh, Scotland), S.K.Sataja, H.Yoshizawa, G.Shirane, R.J.Birgeneau, H.J.Guggenheim.
Phys. Rev. B (USA), vol.28, no.5, p.2602-13 (1 Sept. 1983).
The phase transition and ordering of the $d=3$ diluted Ising antiferromagnet $Co_xZn_{1-x}F_2$ has been studied using two-axis neutron diffraction for the cases (i) where x is close to the percolation threshold, in zero applied magnetic field, and (ii) as a function of applied magnetic field for samples with $x=0.26$ and 0.35. The results of the percolation study show complicated behavior, probably due to concentration gradient problems. Nevertheless, there is strong evidence that the inverse correlation length decreases to zero at the onset of long-range order. The results of the magnetic field study are compared with the theoretical predictions for the $d=3$ Ising model in a random field. It is found that when the samples are cooled in even the smallest (nonzero) fields the long-range magnetic order is destroyed and that the structure factor is well described by the Lorentzian plus Lorentzian squared form. The inverse correlation length is found to have a power-law dependence on the applied magnetic field at low temperature with exponents $\nu_H=2.17\pm0.3$ for the $x=0.26$ sample and $\nu_H=3.63\pm0.3$ for the $x=0.35$ sample. This result is not consistent with the current theoretical predictions for the field dependence of the inverse correlation length in the $d=3$ Ising model in a random field. The measurements also show that the system is frozen at low temperatures and this freezing may be responsible for the discrepancy between theory and experiment. (27 refs.)

119844 Mossbauer studies of the static and dynamic critical behavior of the layered antiferromagnets $RbFeF_4$ and $KFeF_4$. H.Keller, I.M.Savic (Phys.-Inst., Univ. Zurich, Zurich, Switzerland).
Phys. Rev. B (USA), vol.28, no.5, p.2638-52 (1 Sept. 1983).
Detailed ^{57}Fe Mossbauer studies of the static and dynamic critical behavior of the layered antiferromagnets $RbFeF_4$ and $KFeF_4$ are reported. All measurements were performed on single crystals with the direction of the γ rays perpendicular to the magnetic layers. Both systems undergo a second-order phase transitions at the Neel temperature $T_N=133.57(2)$K for $RbFeF_4$ and $T_N=135.79(2)$K for $KFeF_4$. Special attention was given to a careful evaluation of reliable values for the critical indices. In the asymptotic critical region below T_N, the temperature dependence of the hyperfine field H is well described by the power law $H\propto t^\beta$, where β is the static critical exponent of the order parameter, and $t=1-T/T_N$ is the reduced temperature. The following asymptotic values for β were found: $\beta=0.316(3)$ for $RbFeF_4$ in the range $5\times10^{-4}<t<10^{-2}$ and $\beta=0.151(3)$ for $KFeF_4$ in the range $3.8\times10^{-4}<t<5.7\times10^{-2}$. These results indicate that $RbFeF_4$ shows a three-dimensional critical behaviour, in contrast to $KFeF_4$, where the magnetic transition is essentially two dimensional in nature. The present values of β disagree considerably with the nonasymptotic values previously reported by other groups. Just above T_N a characteristic line broadening $\Delta\Gamma$ due to critical spin fluctuations is observed. At the critical point $\Delta\Gamma$ diverges as $\Delta\Gamma\propto|t|^{-w}$, where the exponent ω involves, besides two static exponents, the dynamic exponent z. In the critical region $10^{-4}<|t<10^{-3}$, the following values for w and the corresponding values for z were obtained: $\omega=0.81(6)$, $z=2.15(19)$ for $RbFeF_4$ and $\omega=0.91(5)$, $z=1.29(9)$ for $KFeF_4$. These values are compared to those predicted by the current theory of critical dynamics. At T_N the center shift and the quadrupole splitting shows a pronounced anomaly that appears to be associated with the onset of magnetic ordering. (53 refs.)

119845 A magnetic phase transition in UNi_2Si_2. L.Chelmicki, J.Leciejewicz (Inst. of Nuclear Res., Otwock, Poland), A.Zygmunt.
Solid State Commun. (USA), vol.48, no.2, p.177-9 (Oct. 1983).
Neutron diffraction study of polycrystalline UNi_2Si_2 performed at low temperatures shows that a LSW type of magnetic order present at 4.2K transforms in the temperature range between 53±3K and 70±3K into a collinear antiferromagnetic structure of $+-+-$ type. The Neel point is 103±3K. The magnitude of magnetic moment on U ion is 2.89±0.07 Bohr magnetons at 4.2K and 1.66±0.04 Bohr magnetons at 80K. (10 refs.)

119846 Influence of uniaxial pressure on the Neel temperature of antiferromagnet $CuCl_2.2H_2O$. V.A.Galushko, V.P.Kul'batskii, Yu.G.Pashkevich, V.L.Sobolev, V.T.Telepa (Physicotech. Inst., Acad. of Sci., Donetsk, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.527-8 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR),* vol.25, no.3, p.915-17 (March 1983). [received: Oct. 1983]
The authors describe an investigation of the influence of uniaxial pressure on T_N of $CuCl_2.2H_2O$, which enabled them to determine not combinations of magnetoelastic constants, but their individual values. The influence of uniaxial pressure on T_N was investigated by the NMR method and temperatures T were measured to within $\pm5.10^{-6}$K. (6 refs.)

119847 New magnetic phase transition in manganese ferrite at low temperatures. K.P.Belov, A.N.Goryaga, V.N.Pronin, L.A.Skipetrova (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.548-9 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR),* vol.25, no.3, p.950-3 (March 1983). [received: Oct. 1983]
The authors investigate some of the electrical and magnetic properties of Mn ferrites to determine whether an additional phase transition takes place. They investigated a sample of $MnFe_2O_4$ synthesized by the ceramic technology. The sample was used to measure the longitudinal $(\Delta R/R)\parallel$ and transverse $(\Delta R/R)\perp$ magnetoresistance, magnetocaloric effect ΔT, specific magnetization σ, and electrical resistivity ρ in the temperature range 77-294K. (6 refs.)

Heat capacity of a five-coordinated iron (III) complex, iodobis(*N*,*N*-dimethyldithiocarbamato) iron (III), between 0.4 and 300K ....See Entry 119216

Calculations of the electronic ($4k_F$) and magnetic ($2k_F$) phase transitions from a Hubbard Hamiltonian with an exponentially dependent intersite-transfer integral .... See Entry 119382

High pressure effects in MEM-$(TCNQ)_2$ ....See Entry 119575

Cooperative phenomenon in ternary superconductors ....See Entry 119737

A magnetic state in the organic superconductor $(TMTSF)_2ClO_4$: cooling rate and strong magnetic field effects ....See Entry 119765

Diffusion coefficients of fluctuations in semi-infinite ferromagnets ....
........See Entry 119800

Neutron-scattering study of the randomly mixed antiferromagnet with competing anisotropies $K_2Co_xFe_{1-x}F_4$ ....See Entry 119820

High-pressure synthesis and magnetic properties of the solid solution $MnCr_xSb$ and $CrMn_ySb$ ($0\leq x$, $y\leq1.0$) ....See Entry 119823

Magnets with random uniaxial anisotropy: thermodynamic properties in the large-*N* limit ....See Entry 119831

Low-temperature heat capacity of antiferromagnetic ternary rare-earth iron silicides $M_2Fe_3Si_5$ ....See Entry 119855

Cascade of orientational phase transitions in substituted thulium orthoferrite ...
........See Entry 119858

Random-field critical behaviour of a $d=3$ Ising system ....See Entry 119863

Intermetallic compounds for permanent magnets: current status and future trends .... See Entry 119875

^{1}H-NMR relaxation studies on the nature of the semiconducting state of $(TMTTF)_2Br$ and $(TMTTF)_2PF6$: magnetism .... See Entry 119941

Magnetism in Eu-based amorphous alloys from local and bulk investigations ...
........See Entry 119956

Investigation of magnetic properties of amorphous ferrite magnetic materials by the Mossbauer method .... See Entry 119965

Ferroelectric properties of compounds with magnesium orthotellurate structure
........See Entry 119992

Optical phenomena in $BaMnF_4$ near its phase-transition temperatures ....
........See Entry 120008

75.30S Magnetocaloric effect

New magnetic phase transition in manganese ferrite at low temperatures ....
........See Entry 119847

75.40 CRITICAL-POINT EFFECTS, SPECIFIC HEATS, SHORT-RANGE ORDER

(inc. spin glasses)

119848 Dynamic theory of spin glasses. A.Togashi, M.Suzuki (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.2994-3002 (Sept. 1983).
A dynamic theory of spin glasses is presented based on the extended mean-field theory of Thouless, Anderson, and Palmer. The kinetic equations for the magnetization and the spin correlation function are derived, from which dynamical linear and nonlinear susceptibilities are calculated and their low-frequency behavior is mainly investigated. The spin self-correlated functions have different relaxation times near above and below T_c—the former is proportional to $|T-T_c|^{-2}$, while the latter to $|T-T_c|^{-4}$—which shows the asymmetric critical slowing down. A qualitative comparison of the present results with experimental data is presented.

119849 The dynamical susceptibility of metallic spin glass compound $(Ti_{1-x}V_x)_2O_3$: frequency and field dependences. T.Saito (Dept. of Phys., Hokkaido Univ., Sapporo, Japan), C.J.Sandberg, Y.Miyako.
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3170-9 (Sept. 1983).
The real, Re $_{\chi0}(\omega,H)$, and the imaginary, Im $_{\chi0}(\omega,H)$, components of AC-susceptibility were measured on $(Ti_{0.9}V_{0.1})_2O_3$ and $(Ti_{0.98}V_{0.02})_2O_3$ crystals in the static magnetic field H as well as in zero field. The experimental results were analyzed using a modified Debye model which is applicable to the magnetic system with multi-relaxation times and it was found that spin glass freezing is characterized by a noticeable change in the distribution of relaxation times. The spin glass freezing temperature $T_g(H)$ is determined from the inflection point of $Im_{\chi0}(\omega,H)$ and is given as a function of H. From H vs. $T_g(H)$ curve, the (Almeida-Thouless) critical line $H_c(T)$ is obtained as $H_c(T)\sim\epsilon^{1.6}$, where $\epsilon=(T_g(H)-T_g(0))/T_g(0)$. (40 refs.)

119850 Metastable states in anisotropic spin glasses. II. Uniaxial anisotropy. S.A.Roberts (Dept. of Theoretical Phys., Univ. of Manchester, Manchester, England).
J. Phys. C (GB), vol.16, no.28, p.5465-79 (10 Oct. 1983).
For pt.I see ibid., vol.15, p.4155 (1982). The numbers N_s and properties of the zero-temperature metastable states of an infinite-range spin glass with single-ion uniaxial anisotropy are investigated. The 'direct average' $\langle N_s\rangle_J$ over the bond distribution is evaluated, rather than $\langle \text{In } N_s\rangle_J$, leading to results which are exact above a critical energy ϵ_c. The phase transitions found in the model by Roberts and Bray (1982) and Cragg and Sherrington (1982) are again present. The Hessian and spin-wave spectra are found to be gapless in all three phases. (16 refs.)

119851 Spin glass-like behaviour in the 1D mixed compound CHAC:Mn. A.Cheikhrouhou (Faculte des Sci. et Tech. de Sfax, Sfax, Tunisia), C.Dupas, J.P.Renard.
J. Phys. Lett. (France), vol.44, no.18, p.L777-84 (15 Sept. 1983).
The a.c. susceptibility of the quasi-1D mixed compound $C_6H_{11}NH_3Cu_{1-x}Mn_xCl_3$ (CHAC:Mn) exhibits at T_{max} a frequency dependent maximum. Remanence effects on the magnetization appear below T_{max}. The variations with field, time and temperature of the thermoremanent and isothermal remanent magnetizations are similar to those observed in classical spin glasses. These measurements suggest spin glass-like behaviour in linear chains with random exchange at very low impurity concentration. (11 refs.)

119852 Change of concavity of the field temperature transition lines at short times in the $Eu_{0.4}Sr_{0.6}S$ spin glass. J.Rajchenbach, N.Bontemps (Lab. d'Optique Phys., ESPCI, Paris, France).
J. Phys. Lett. (France), vol.44, no.18, p.L799-804 (15 Sept. 1983).
The authors report on the transverse and longitudinal response in $Eu_{0.4}Sr_{0.6}S$ with a small a.c. field (10^2-10^5 Hz) superimposed to a large static one. From the onset of the imaginary susceptibility, they derive transition lines, identical in both configurations, which exhibit, at low field, a reversed curvature more pronounced with increasing frequency. The isotropy of the response is assigned to the dipolar interaction. The results are compared to mean field theory and numerical simulations. (20 refs.)

119853 Local environment effects on the magnetic state of Fe in amorphous $Cu_{0.6}Zr_{0.4-x}Fe_x$ alloys. H.Von Lohneysen, G.V.Lecomte, J.Kastner, H.J.Schink, R.Van Den Berg (Phys. Inst., RWTH Aachen, Aachen, Germany).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.47-50 (3 Oct. 1983).
Measurements of the susceptibility χ and specific heat C of melt-spin amorphous $Cu_{0.6}Zr_{0.4-x}Fe_x$ ($0.05\leq x\leq0.1$) are reported. They show that for $x=0.08$ and $x=0.1$ a small fraction of Fe atoms retain their magnetic moment, leading to spin glass like behaviour in χ and C. In contrast, for $x=0.05$ no magnetic Fe atoms can be detected from χ, and bulk supercon-

ductivity is observed below 0.1K. These results are attributed to the strong sensitivity of the Fe magnetic moment to its local environment. (18 refs.)

119854 Role of initial conditions in the mean-field theory of spin-glass dynamics. A.Houghton, S.Jain, A.P.Young (Dept. of Maths., Imperial Coll., London, England).
Phys. Rev. B (USA), vol.28, no.5, p.2630-7 (1 Sept. 1983).
The authors discuss the dynamics of the infinite-range Sherrington-Kirkpatrick spin-glass model for which relaxation times diverge when N, the number of spins, tends to infinity. Calculations on large but finite system are very difficult, so they mimic a large finite system in equilibrium by working with $N=\infty$ and imposing, by hand, a canonical distribution at an initial time. For short times, where no barrier hopping has occurred, they find that the Edwards-Anderson order parameter, q_{EA}, is identical to that obtained from an analysis of the mean-field equations of Thouless, Anderson, and Palmer and, with further assumptions, gives $q(x=1)$ in Parisi's theory, in agreement with earlier work. For times longer than the longest relaxation time (of the finite system), true equilibrium is reached and the authors' theory agrees with previous statistical-mechanics calculations using the replica trick. There is no violation of the fluctuation-dissipation theorem. (19 refs.)

119855 Low-temperature heat capacity of antiferromagnetic ternary rare-earth iron silicides $M_2Fe_3Si_5$. C.B.Vining, R.N.Shelton (Dept. of Phys., Iowa State Univ., Ames, IA, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2732-42 (1 Sept. 1983).
The low-temperature heat capacity of antiferromagnetic ternary iron silicides $M_2Fe_3Si_5$ (M=Sm, Gd-Yb) has been measured from 0.5 to 30K. Antiferromagnetic ordering temperatures range from 1.06 to 10K for these materials including multiple magnetic transitions in $Sm_2Fe_3Si_5$, $Tb_2Fe_3Si_5$, and $Er_2Fe_3Si_5$. Magnetic ordering via the Ruderman-Kittel-Kasuya-Yosida interactions is indicated, even in the presence of large crystalline electric field effects. Entropy considerations indicate the magnetic ground state is a doublet in all of these materials except $Gd_2Fe_3Si_5$. Anomalous behaviour is observed with respect to spin-wave and nuclear contributions to the total heat capacity, crystalline electric field effects, and critical behavior. (14 refs.)

119856 The H-T phase diagram of the Y:Er spinglass. R.Wendler, K.Baberschke (Inst. fur Atom- und Festkorperphys., Freie Univ. Berlin, Berlin, Germany).
Solid State Commun. (USA), vol.48, no.2, p.91-4 (Oct. 1983).
DC magnetization measurements are presented for 4% YEr single crystals—an Ising like spinglass. The onset of irreversibilities, defined by $T_f(H)$, follows the theoretical predictions of the mean field Ising calculation by de Almeida-Thouless (1978). In addition, the onset of viscous behavior, determined by the time dependence of the magnetization, agrees with the AT line of instability, too. (25 refs.)

119857 On the behaviour of spin-glasses in crossed magnetic fields. S.V.Maleyev (Leningrad Nuclear Phys. Inst., Leningrad, USSR).
Solid State Commun. (USA), vol.48, no.4, p.329-31 (Oct. 1983).
The information on the dynamical properties of spin-glasses which can be measured from experimental investigation of magnetization induced by two crossed magnetic fields is discussed. (8 refs.)

119858 Cascade of orientational phase transitions in substituted thulium orthoferrite. A.M.Kadomtseva, I.B.Krynetskii, K.Krezhov, A.S.Moskvin, T.L.Ovchinnikova, M.M.Lukina (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.502-3 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.877-80 (March 1983). [received: Oct. 1983]
An investigation of the nature of various spin-reorientation transitions observed in pure and substituted rare-earth orthoferrites has provided information necessary for the control of the magnetic anisotropy of these compounds. The authors report that introduction of a certain amount (x=0.3) of the Jahn-Teller Mn^{3+} ions into thulium orthoferrite gives rise to a whole cascade of spin-reorientation transitions. They carried out a comprehensive (including neutron-diffraction) investigation of changes in the magnetic structure as a result of spin reorientation in $TmFe_{1-x}Mn_xO_3$ orthoferrites with x=0.12, 0.21, and 0.33. (4 refs.)

Correlation between magnetoresistance and magnetization in *Ag*Mn and *Au*Mn spin-glasses .... See Entry 119549

Effect of ageing heat treatment on the magnetic behaviour of a gold-iron alloy .... See Entry 119826

Magnetic excitations in the triangular spin structure of singlet-ground-state hexagonal antiferromagnet $RbFeCl_3$ .... See Entry 119828

Magnets with random uniaxial anisotropy: thermodynamic properties in the large-N limit .... See Entry 119831

Reversibility of phase transition of antiferromagnetic $CoCl_2.6H_2O$ under hydrostatic pressure .... See Entry 119836

Reentry and coexistence behavior of the magnetic superconductor $(Th_{1-x}Nd_x)Ru_2$ .... See Entry 119840

Magnetism in Eu-based amorphous alloys from local and bulk investigations .... See Entry 119956

75.40D Ising and other classical spin models

119859 Theory on the two- and three-dimensional Ising model with periodically distributed frustrations. T.Oguchi (Dept. of Phys., Tokyo Inst. of Technol., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3101-9 (Sept. 1983).
The approximate theory on the Ising model with periodically distributed frustrations is proposed and applied to several two- and three-dimensional lattices. In this theory the lattice is divided into several sublattices and the molecular field at each sublattice is determined self-consistently. The transition temperature, thermal average of spin, and spin correlation functions between nearest neighbors are calculated and discussed. (16 refs.)

119860 Surface magnetism in amorphous semi-infinite Ising ferromagnets. I.Tamura, T.Kaneyoashi (Dept. of Phys., Nagoya Univ., Nagoya, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3208-14 (Sept. 1983).
Surface magnetism and phase diagram in amorphous semi-infinite ferromagnets are studied on the basis of the lattice model of amorphous magnets. The authors find that surface ordering is expected in amorphous ferromagnets more than in crystalline ones.

119861 Direct determination of the probability distribution for the spin-glass order parameter. A.P.Young (Dept. of Maths., Imperial Coll., London, England).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1206-9 (26 Sept. 1983).
The recent interpretation of Parisi's (1980) order-parameter function $q(x)$ in terms of a probability distribution for the overlap between magnetizations in different phases is investigated by Monte Carlo computer simulation for the infinite-range Ising spin-glass model. The main features of the solution for $q(x)$ are reproduced, in particular $q(x)\propto x$ as $x\rightarrow 0$ and $q'(x)=0$ at $q=q_{max}$, the largest value. Finite-size effects prevent one from establishing with certainty whether there is a 'plateau', i.e. $q'(x)=0$ for a range of x. (15 refs.)

119862 Phase diagram of a spin glass of $Eu_pSr_{1-p}S$. S.Katsura, A.Matsuno (Dept. of Appl. Phys., Tohoku Univ., Sendai, Japan).
Phys. Status Solidi b (Germany), vol.119, no.1, p.73-7 (1 Sept. 1983).
$Eu_pSr_{1-p}S$ is modeled as a site-diluted Ising model with first and second neighbor interactions ($J>0$, $J'<0$) between Eu atoms, on a lattice with square coordination number z_c. By use of the reducibility of the four-body density matrix to the one-body density matrix, an integral equation for the distribution function for the effective field is obtained. The integral equation for the case $J'=-J/2$ is solved exactly at $T=0$ in the case of $z_c=2$ and the three solutions for the paramagnetic, ferromagnetic, and the spin glass states are obtained. The boundary between the ferromagnetic and spin glass state is given by $p_{FG}=0.545$ and the phase diagram shows a reentrant behavior. (4 refs.)

119863 Random-field critical behaviour of a $d=3$ Ising system. D.P.Belanger, A.R.King, V.Jaccarino, J.L.Cardy (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2522-6 (1 Sept. 1983).
Optical birefringence studies of the randomly diluted, $d=3$ Ising antiferromagnet $Fe_{0.6}Zn_{0.4}F_2$ reveal that the magnetic specific heat exhibits a symmetric logarithmic singularity, consistent with an effective dimensionality $\bar{d}\simeq 2$, in small magnetic fields H applied parallel to the unique axis. The nature and the sharpness of the phase transition for $H\leq 20$ kOe and reduced temperature $5\times 10^{-4}\leq t\leq 10^{-1}$ suggest that the lower critical dimensionality $d_l<3$. Both of these results are inconsistent with the predicted mapping $\bar{d}=d-2$, for the random-field problem, obtained from perturbation theory. The observed crossover exponent $\phi=1.40\pm 0.05$ agrees with both the measured and predicted random-exchange susceptibility exponent γ as is to be expected. The observed amplitude of the shift in T_c with H agrees with a new theory of random-field effects in diluted antiferromagnets. (28 refs.)

119864 External stress influence on the spin-Peierls phase diagram of the XY model. R.A.T.de Lima (Dept. de Fisica, Univ. Federal de Sao Carlos, Sao Carlos, Sao Paulo, Brazil), C.Tsallis.
Solid State Commun. (USA), vol.48, no.4, p.321-4 (Oct. 1983).
The authors discuss, within a framework in which the structural degrees of freedom (assumed essentially three-dimensional) are adiabatically treated and the magnetic degrees of freedom are exactly treated (as far as the disordered-phase results and the second order critical frontiers are concerned), the stress-(magnetic) field-temperature phase diagram associated withthe one-dimensional first-neighbour spin-$^1/_2$ magneto strictive XY model. The important influence of the curvature of the coupling constant as a function of distance is exhibited and satisfactorily compared to experimental data. (11 refs.)

Diffusion coefficients of fluctuations in semi-infinite ferromagnets .... See Entry 119800

Digital dynamics and the simulation of magnetic systems .... See Entry 119801

Surface tension, roughening, and lower critical dimension in the random-field Ising model .... See Entry 119802

Random fields and three-dimensional Ising models: $Co_xZn_{1-x}F_2$ .... See Entry 119843

75.40F Heisenberg and other quantized spin models

119865 Vanishing spontaneous magnetization for quantum mechanical models of a spin glass. W.F.Wreszinski (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
J. Stat. Phys. (USA), vol.32, no.2, p.407-12 (Aug. 1983).
The author proves that the spontaneous magnetization vanishes identically (independently of boundary conditions) for certain quantum mechanical models of a spin glass. (16 refs.)

75.50 STUDIES OF SPECIFIC MAGNETIC MATERIALS

(see also 81.40R Magnetic properties related to materials treatment)

75.50B Ferromagnetism of Fe and its alloys

Stress dependence of magnetically induced ultrasonic shear wave velocity change in polycrystalline A-36 steel .... See Entry 119111

Hall effect in Ni-rich $Fe_xNi_{80-x}B_{18}Si_2$ amorphous alloys .... See Entry 119548

Magnetic, chemical and structural ordering in transition metals .... See Entry 119821

Effect of ageing heat treatment on the magnetic behaviour of a gold-iron alloy .... See Entry 119826

Local environment effects on the magnetic state of Fe in amorphous $Cu_{0.6}Zr_{0.4-x}Fe_x$ alloys .... See Entry 119853

Frequency dependence of the complex initial permeability on Permalloy strips .... See Entry 119870

On the coercive field of the nearly non-magnetostrictive amorphous ferromagnetic alloy $Co_{58}Ni_{10}Fe_5Si_{11}B_{16}$ .... See Entry 119871

High coercive force 2-17-type $Sm_{1-x}Er_x(Co_{0.69}Fe_{0.22}Cu_{0.08}Zr_{0.02})_{7.22}$ magnets with a low temperature coefficient .... See Entry 119873

Intermetallic compounds for permanent magnets: current status and future trends .... See Entry 119875

Crystallographic structures and perpendicular magnetization of GdFe films sputtered with substrate bias voltage .... See Entry 119877

^{57}Fe Mossbauer effect evidence for magnetostruction in UFe_2 .... See Entry 119890

Atomic structure and magnetic properties of the pseudobinary alloys $Fe_3(Al, Si)$ .... See Entry 119963

Effect of electrolysis time on the magnetic properties of fine iron powders .... See Entry 120275

On the high-energy product Fe-Pt permanent magnet alloys .... See Entry 120455

75.50C Ferromagnetism of other metals

Magnetic, chemical and structural ordering in transition metals .... See Entry 119821

High-pressure synthesis and magnetic properties of the solid solution $MnCr_xSb$ and $CrMn_ySb$ ($0 \leq x,\ y \leq 1.0$) .... See Entry 119823

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75.50D Ferromagnetism of nonmetals

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Magnetic properties of $Cr_{1-x}Fe_xGe$ .... See Entry 119822

Magnetic properties of cobalt (II) atoms in solid solutions $Co_xMg_{2-x}GeO_4$ .... See Entry 119830

Magnetic and Mossbauer studies of some mixed cobaltites of the lanthanides and alkali metals .... See Entry 119872

Domain wall mobility in epitaxial iron garnet films .... See Entry 119883

75.50E Antiferromagnetics

Heat capacity of a five-coordinated iron (III) complex, iodobis(*N,N*-dimethyldithiocarbamato) iron (III), between 0.4 and 300K .... See Entry 119216

Extraordinary Hall resistivity in amorphous terbium-iron thin films and its temperature dependence .... See Entry 119546

Neutron-scattering study of the randomly mixed antiferromagnet with competing anisotropies $K_2Co_xFe_{1-x}F_4$ .... See Entry 119820

Magnetic, chemical and structural ordering in transition metals .... See Entry 119821

Susceptibility anisotropy in TMTTF salts .... See Entry 119824

Magnetic properties of some morpholinium $(TCNQ)_2$ salts .... See Entry 119825

Magnetic excitations in the triangular spin structure of singlet-ground-state hexagonal antiferromagnet $RbFeCl_3$ .... See Entry 119828

Reversibility of phase transition of antiferromagnetic $CoCl_2.6H_2O$ under hydrostatic pressure .... See Entry 119836

A microscopic theory of the phase transition in $RbFeCl_3$-type hexagonal antiferromagnets: effects of the dipole-dipole interaction .... See Entry 119837

Origin of antiferromagnetic ordering in Bechgaard salts .... See Entry 119838

Magnetic study of the phase transitions in $(TMTTF)_2X$ salts .... See Entry 119839

Critical composition of antiferromagnetic ordering in Un_xC_{1-x} .... See Entry 119841

Random fields and three-dimensional Ising models: $Co_xZn_{1-x}F_2$ .... See Entry 119843

Mossbauer studies of the static and dynamic critical behavior of the layered antiferromagnets $RbFeF_4$ and $KFeF_4$ .... See Entry 119844

A magnetic phase transition in UNi_2Si_2 .... See Entry 119845

Influence of uniaxial pressure on the Neel temperature of antiferromagnet $CuCl_2.2H_2O$ .... See Entry 119846

Low-temperature heat capacity of antiferromagnetic ternary rare-earth iron silicides $M_2Fe_3Si_5$ .... See Entry 119855

Random-field critical behaviour of a $d=3$ Ising system .... See Entry 119863

Interchain interactions in the highly one dimensional tetraethyl ammonium bis(maleonitrile dithiolato) nickelate, NEt_4 Ni mnt_2 .... See Entry 119907

^1H NMR relaxation studies of the organic conductor series $(TMTTF)_2X$; $X=BF_4$, PF_6, SCN .... See Entry 119940

Dielectric, pyroelectric, and magnetic properties of $BiMn_2O_5$ crystals .... See Entry 119989

75.50G Ferrimagnetics

Electrical resistivity of ferrites of the general formula $Mg_{1+t}Fe_{2-2t}Ti_tO_4(t=0.1, 0.3, 0.4, 0.5)$ .... See Entry 119599

Anisotropy and exchange effects in heavy rare-earth-cobalt compounds of the RCo_5 type .... See Entry 119832

Magnetic anisotropy of ion-implanted layers in iron garnet films .... See Entry 119833

New magnetic phase transition in manganese ferrite at low temperatures .... See Entry 119847

Cascade of orientational phase transitions in substituted thulium orthoferrite .... See Entry 119858

Effect of replacing iron with titanium, zirconium, and hafnium on the initial magnetic permeability of manganese-zinc ferrites .... See Entry 119866

Superparamagnetism and magnetic granulometry of vitroceramics containing iron-lithium ferrite .... See Entry 119876

Static properties of magnetic bubbles in garnet films with orthorhombic anisotropy .... See Entry 119881

Ferromagnetic resonance study of magnetic anisotropy and domain observations in implanted garnets misoriented from (111) .... See Entry 119882

Formation of an array of magnetic bubbles in ferrite garnet films .... See Entry 119884

Properties of ferrimagnetic echoes in yttrium iron garnet cylinders .... See Entry 119921

Investigation of magnetic properties of amorphous ferrite magnetic materials by the Mossbauer method .... See Entry 119965

Analysis and classification of layer-by-layer heterogeneities of microstructures .... See Entry 120156

Substitution reactions in solvent-ferrite systems and acid-base properties of the components .... See Entry 120238

75.50K Amorphous magnetic materials

Electronic properties of Cu-Ti metallic glasses .... See Entry 119542

Extraordinary Hall resistivity in amorphous terbium-iron thin films and its temperature dependence .... See Entry 119546

Hall effect in Ni-rich $Fe_xNi_{80-x}B_{18}Si_2$ amorphous alloys .... See Entry 119548

Local environment effects on the magnetic state of Fe in amorphous $Cu_{0.6}Zr_{0.4-x}Fe_x$ alloys .... See Entry 119853

On the coercive field of the nearly non-magnetostrictive amorphous ferromagnetic alloy $Co_{58}Ni_{10}Fe_5Si_{11}B_{16}$ .... See Entry 119871

Changes in the remanent magnetisation, magnetoelastic coupling and Young's modulus during structural relaxation of an amorphous ribbon .... See Entry 119888

Magnetism in Eu-based amorphous alloys from local and bulk investigations .... See Entry 119956

Investigation of magnetic properties of amorphous ferrite magnetic materials by the Mossbauer method .... See Entry 119965

75.60 DOMAIN EFFECTS, MAGNETIZATION CURVES, AND HYSTERESIS

Changes in the remanent magnetisation, magnetoelastic coupling and Young's modulus during structural relaxation of an amorphous ribbon .... See Entry 119888

On the high-energy product Fe-Pt permanent magnet alloys .... See Entry 120455

75.60C Domain walls and domain structure

(for magnetic bubbles, see 75.70K)

Surface tension, roughening, and lower critical dimension in the random-field Ising model .... See Entry 119802

Mossbauer-effect study of the Morin transition and atomic positions in hematite under pressure .... See Entry 119842

Magnetic and Mossbauer studies of some mixed cobaltites of the lanthanides and alkali metals .... See Entry 119872

Superparamagnetism and magnetic granulometry of vitroceramics containing iron-lithium ferrite .... See Entry 119876

Static properties of magnetic bubbles in garnet films with orthorhombic anisotropy .... See Entry 119881

Ferromagnetic resonance study of magnetic anisotropy and domain observations in implanted garnets misoriented from (111) .... See Entry 119882

Domain wall mobility in epitaxial iron garnet films .... See Entry 119883

Magnetoelastic dynamics of amorphous ferromagnets .... See Entry 119886

The dependence of magnetic domain structure upon magnetization state with emphasis upon nucleation as a mechanism for pseudo-single-domain behavior .... See Entry 121226

75.60E Magnetization curves, hysteresis, Barkhausen and related effects

119866 Effect of replacing iron with titanium, zirconium, and hafnium on the initial magnetic permeability of manganese-zinc ferrites. G.V.Fomenko, L.A.Bashkirov (Inst. of Solid-State Phys. & Semiconductors, Acad. of Sci., Belorussian SSR).
Inorg. Mater. (USA), vol.18, no.11, p.1622-4 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1886-9 (Nov. 1982).
The temperature dependence of the initial magnetic permeability of the ferrites $Mn_{0.8}Zn_{0.2}Fe_x{}^{2+}M_x{}^{4+}M_x{}^{4+}Fe_{2-2x}{}^{3+}O_4$ and $Mn_{0.59+y}Zn_{0.3}Fe_{0.11}{}^{2+}M_y{}^{4+}Fe^{3+}{}_{2-2y}O_4$, where M is Ti, Zr, or Hf, x=0, 0.02, 0.04, 0.06, 0.08, 0.105, or 0.13, y=0, 0.02, 0.05, 0.07, 0.11, has been investigated. For certain compositions a weak dependence of the initial magnetic permeability on temperature is observed over certain temperature intervals. (6 refs.)

119867 Space-time correlation properties of the magnetization process and eddy current losses: theory. G.Bertotti (Istituto Elettrotecnico Nazionale Galileo Ferraris, CNR, Torino, Italy).
J. Appl. Phys. (USA), vol.54, no.9, p.5293-305 (Sept. 1983).
The relationship between eddy current losses and magnetization dynamics is investigated on general bases, starting directly from the Maxwell equations. The intrinsically stochastic character of the magnetization process is conveniently dealt with by describing the magnetization rate $\dot{I}(\mathbf{r},t)$ as a random sequence of elementary magnetization jumps, each corresponding to a sudden and localized displacement of a domain wall segment in the material. A general equation is obtained, in which the loss is expressed in terms of the average energy spectrum $|\dot{I}(\mathbf{k},\omega)|^2$ of $\dot{I}(\mathbf{r},t)$. The loss calculation is thus reduced to the statistical problem of determining the energy spectrum of the random quantity $\dot{I}(\mathbf{r},t)$ as a function of the shape and correlation properties of the elementary magnetization events. It turns out that the hysteresis loss is related to the internal structure of the elementary jumps, while the dynamic and anomalous losses are instead determined by the space-time correlation properties of the jump sequence. An explicit expression for the dynamic loss is obtained in the important case where the magnetization process is described as a Markov process, leading to a clear-cut, direct link between the loss and the fundamental quantities which characterize the magnetization dynamics at a microscopic level. The model predicts the exact value of the Pry and Bean loss, as a particular case corresponding to very specialized correlation properties of the jump sequence. However, the model permits one to deal with actually more general and realistic descriptions of the domain structure dynamics. It is believed that future applications to practical cases will provide a deeper understanding of the physical origin of loss anomalies. (20 refs.)

119868 Magnetization reversal in cobalt-phosphorus films. G.F.Hughes (Seagate Technol., Scotts Valley, CA, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5306-13 (Sept. 1983).
A brief review is given of preparation, structure, and magnetization reversal in Co-P thin films for digital recording. From this, a magnetization reversal theory is developed which correctly predicts a number of observed facts about

Co-P. Among these are $M_r/M_s>0.80$, $H_c/H_k\simeq0.1$ (conventional theory predicts 0.64 and 0.52, respectively), avalanche and cluster reversal mechanisms, transverse ripple, and sawtooth structure in recorded bits. Limitations to high bit and track density recording are discussed. It is suggested that lower M_r/M_s remanent squareness values may alleviate these density limiting mechanisms. (55 refs.)

119869 On the mean field theory bound on the magnetization. J.Slawny (Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
J. Stat. Phys. (USA), vol.32, no.2, p.375-88 (Aug. 1983).
The mean field bound on magnetization is proved for a class of one-component ferromagnetic systems and for D components systems with arbitrary D. (7 refs.)

119870 Frequency dependence of the complex initial permeability on Permalloy strips. G.Dietzmann, M.Schaefer (Sektion Phys., Karl-Marx-Univ. Leipzig, Leipzig, Germany).
Nachrichtentech. Elektron. (Germany), vol.33, no.9, p.375-81 (1983). In German.
Eddy-current loci of the complex permeability of sheet metals are calculated in the case of disappearing alternating field strength on the assumption that the local initial permeability decreases from the sheet metal middle towards the surfaces according to a power law. The theory allows the description of measured loci of Permalloy strips of different thickness within a mean error of 1%. A semicircle approximation is indicated which approximates very well the theoretical loci up to the frequencies at which the loss component of the complex permeability passes the maximum. (12 refs.)

119871 On the coercive field of the nearly non-magnetostrictive amorphous ferromagnetic alloy $Co_{58}Ni_{10}Fe_5Si_{11}B_{16}$. W.Beck, H.Kronmuller (Inst. fur Theoretische und Angewandte Phys., Univ. Stuttgart, Stuttgart, Germany).
Phys. Status Solidi a (Germany), vol.79, no.1, p.109-14 (Sept. 1983).
The coercive field of nearly non-magnetostrictive amorphous alloys is predominantly determined by quenching conditions, relaxation processes, and the surface roughness. Taking into account surface effects and magnetostrictive contributions to the coercive field it is possible to separate different coercive field contributions and to predict the value and the conditions for obtaining a minimum coercive field. The effects of the quenching rate on spin quenched ribbons are measured. (13 refs.)

119872 Magnetic and Mossbauer studies of some mixed cobaltites of the lanthanides and alkali metals. D.K.Chakrabarty, A.Bandyopadhyay, S.B.Patil, S.N.Shringi (Dept. of Chem., Indian Inst. of Technol., Bombay, India).
Phys. Status Solidi a (Germany), vol.79, no.1, p.213-22 (Sept. 1983).
Magnetic and Mossbauer studies are carried out on compounds $M_xLn_{1-x}CoO_3$ where M is Ba or Sr and Ln is La, Nd or Dy. All compositions with $x>0.2$ with the exception of the dysprosium compounds are ferromagnetic at low temperatures. From hysteresis and initial susceptibility studies, it is concluded that they contain a number of single domain clusters in a paramagnetic matrix. Mossbauer spectra of $Ba_{0.3}Nd_{0.7}CoO_3$ and $Ba_{0.5}Dy_{0.5}CoO_3$ show two resonance lines and that of $Sr_{0.5}La_{0.5}CoO_3$ shows a single line spectrum at all temperatures, and no hyperfine spectra are shown even far below T_C. The results are interpreted in terms of short-range magnetic ordering in these systems. (24 refs.)

Magnetic, elastic, and thermal properties of Rb_2NaHoF_6 ......See Entry 119188

Correlation between magnetoresistance and magnetization in *Ag*Mn and *Au*Mn spin-glasses ....See Entry 119549

Diffusion coefficients of fluctuations in semi-infinite ferromagnets ....See Entry 119800

High-pressure synthesis and magnetic properties of the solid solution $MnCr_xSb$ and $CrMn_ySb$ ($0\leq x$, $y\leq1.0$) ....See Entry 119823

Effect of ageing heat treatment on the magnetic behaviour of a gold-iron alloy ....See Entry 119826

New magnetic phase transition in manganese ferrite at low temperatures ....See Entry 119847

Spin glass-like behaviour in the 1D mixed compound CHAC:Mn ....See Entry 119851

The H-T phase diagram of the Y:Er spinglass ....See Entry 119856

On the behaviour of spin-glasses in crossed magnetic fields .. See Entry 119857

Direct determination of the probability distribution for the spin-glass order parameter .... See Entry 119861

Superparamagnetism and magnetic granulometry of vitroceramics containing iron-lithium ferrite ....See Entry 119876

Crystallographic structures and perpendicular magnetization of GdFe films sputtered with substrate bias voltage ....See Entry 119877

A comparison of the uniaxial anisotropy in sputtered Co-Re and Co-Cr perpendicular recording media .... See Entry 119878

Pulsed magnetization switching in iron garnet films ....See Entry 119880

The influence of cold-working on magnetic properties in Ni_3Al ....See Entry 119889

The magnetic and magnetoelastic properties of amorphous metallic ribbons ....See Entry 119891

Conditions of formation, structure, and magnetic properties of finely divided iron produced in the presence of ED-20 epoxide oligomer and oleic acid ....See Entry 120276

The dependence of magnetic domain structure upon magnetization state with emphasis upon nucleation as a mechanism for pseudo-single-domain behavior ....See Entry 121226

Ferromagnetic resonance and magnetic properties of ALHA 81005 ....See Entry 121620

75.60G High coercivity materials

119873 High coercive force 2-17-type $Sm_{1-x}Er_x(Co_{0.69}Fe_{0.22}Cu_{0.08}Zr_{0.02})_{7.22}$ magnets with a low temperature coefficient. H.F.Mildrum, J.B.Krupar (Magnetics Lab., School of Engng., Univ. of Dayton, Dayton, OH, USA), A.E.Ray.
J. Less-Common Met. (Switzerland), vol.93, no.2, p.261-7 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
High energy permanent magnet alloys with internal temperature compensation corresponding to the formula $Sm_{1-x}Er_x(Co_{0.69}Fe_{0.22}Cu_{0.08}Zr_{0.02})_{7.22}$ ($x=0$, 0.2, 0.4) were characterized by optical metallography, combined scanning electron microscopy and energy-dispersive X-ray analysis, electron microprobe analysis and X-ray diffraction. Sintered magnets were prepared from the induction-melted alloys, ground in the as-cast and homogenized states and sintered with and without a sintering aid. Reversible temperature coefficients α and salient magnetic properties were also investigated. These results indicate that erbium-containing alloy compositions, with proper sintering, solutioning, isothermal aging and controlled cooling heat treatments, can achieve a very high coercive force combined with the desired thermal magnetic behavior for many device applications. (14 refs.)

119874 Internal temperature compensation of rare earth-cobalt permanent magnets for microwave devices by adding heavy lanthanides. K.J.Strnat (Dept. of Electrical Engng., Univ. of Dayton, Dayton, OH, USA), A.Tauber.
J. Less-Common Met. (Switzerland), vol.93, no.2, p.269-74 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
The temperature variation of the remanent flux of rare earth-transition metal permanent magnets can be minimized by making appropriate substitutions of heavy lanthanides in the alloy. The underlying physical principle, its use in sintered magnets and some problems and limitations are reviewed. Recent successful applications to 2-17-type magnets are discussed. Difficulties in using the concept of temperature coefficient are outlined. (27 refs.)

119875 Intermetallic compounds for permanent magnets: current status and future trends. K.S.Narasimhan (Crucible Res. Center, Colt Industries, Pittsburgh, PA, USA).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.275 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
Summary form only given, as follows. Permanent magnets have found an important place in modern technology by providing a convenient medium for the transfer of energy from one form to another. A variety of intermetallic compounds containing cobalt and iron have been synthesized, some of which have found use as permanent magnets. The basic requirements for an alloy to be a permanent magnet are a reasonable saturation magnetization, a high Curie temperature and shape or crystal anisotropy. Alnicos, elongated single-domain materials and oxide ferrites have satisfied these requirements and have been in commercial production for over 20 years. The increasing need for higher saturation magnetization and coercive force combined with the demand for materials with reduced cobalt content and better machinability has resulted in the development of newer magnetic materials during the past decade which satisfied one or more of the needs of the magnet industry.

75.60J Fine-particle systems

119876 Superparamagnetism and magnetic granulometry of vitroceramics containing iron-lithium ferrite. C.Chaumont, J.C.Bernier (Dept. Sci. des Materiaux, CNRS, ENSCS, Strasbourg, France).
Solid State Commun. (USA), vol.48, no.4, p.357-9 (Oct. 1983).
Magnetic properties of lithium ferrite crystallites distributed in a glassy matrix vary with their average size d: (1) $d\leq100$ Å: superparamagnetism d and the limits of the distribution have been calculated by fitting magnetisation curves vs. applied field, (2) $d\gtrsim150$ Å: ferrimagnetism with a hysteresis loop maximum for the monodomain size (260 ± 40 Å). (3) $100\leq d\leq150$ Å: superposition of the two preceding phenomena. (10 refs.)

Effect of electrolysis time on the magnetic properties of fine iron powders ....See Entry 120275

Conditions of formation, structure, and magnetic properties of finely divided iron produced in the presence of ED-20 epoxide oligomer and oleic acid ....See Entry 120276

75.70 MAGNETIC FILMS AND PLATES

119877 Crystallographic structures and perpendicular magnetization of GdFe films sputtered with substrate bias voltage. M.Nawate, M.Ohkoshi, S.Honda, T.Kusuda (Dept. of Electronics, Hiroshima Univ., Higashi-Hiroshima, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L447-9 (July 1983).
Crystallographic structures of sputtered Fe and GdFe films both with and without substrate bias voltage were investigated using an X-ray diffractometer. Films sputtered from lower Gd composition target show the crystalline phase. It was found that (110) orientation of BCC Fe in the films was improved by the small amount of incorporated Gd atoms with the existence of substrate bias voltage. Films possessing magnetization aligned perpendicular to the film plane were obtained with the application of −200 V and −300 V bias voltage to the substrate. (8 refs.)

119878 A comparison of the uniaxial anisotropy in sputtered Co-Re and Co-Cr perpendicular recording media. Tu Chen, G.B.Charlan (Xerox Palo Alto Res. Center, Palo Alto, CA, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5103-11 (Sept. 1983).
The effect of the presence of an intermetallic compound on the microstructure, crystalline anisotropic orientation, and perpendicular magnetic hysteretic properties was investigated based on CoRe and CoCr alloys. The results suggest that a phase segregation causes the formation of an intermetallic compound, Co_3Cr, in the Co-rich CoCr alloy film. Consequently, it leads to the growth of isolated columnar particles because of the fact that the alloy composition lies within the two-phase region in the phase diagram. For homogeneous CoRe and CoCr alloys at high temperature, the resultant microstructures in a deposited film show equiaxial particles characterized by a large grain diameter. Magnetic hysteretic measurement on the film having various microstructure shows that high coercivity and good perpendicular anisotropy in the CoCr film is primarily due to the formation of isolated columnar particles in addition to the *c*-axis preferred orientation. Films having good *c*-axis preferred orientation but not the isolated columnar structure can not give good hysteretic properties for perpendicular recording media application. Also it was concluded in this work that in an isolated columnar structure film, the extent of *x*-axis dispersion (i.e., the value of $\Delta\theta_{50}$) affects the sharpness of the knee, but the H_c of the perpendicular hysteresis loop is not affected significantly. (17 refs.)

119879 Interface magnetism of Fe-Sb multilayered films with artificial superstructure from ^{57}Fe and ^{121}Sb Mossbauer spectroscopy, neutron diffraction and FMR experiments. T.Shinjo, N.Hosoito, K.Kawaguchi, T.Takada (Inst. for Chem. Res., Kyoto Univ., Uji, Kyoto, Japan), Y.Endoh, Y.Ajiro, J.M.Friedt.
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3154-62 (Sept. 1983).
Multilayered films with artifical superstructure, consisting of Fe and Sb layers were prepared by UHV deposition technique. Individual Fe and Sb layers were varied from 2 to 42 Å and from 8 to 41 Å, respectively. ^{57}Fe and ^{121}Sb Mossbauer spectroscopy, neutron diffraction and ferromagnetic resonance experiments were applied to these films and the magnetic properties of the Fe interface in contact with Sb are discussed.

119880 Pulsed magnetization switching in iron garnet films. V.V.Randoshkin, A.F.Martynov, Yu.A.Durasova, M.A.Lyu-fachun (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.537-8 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.931-4 (March 1983). [received: Oct. 1983]
The authors report an investigation of the influence of a static bias field H_b and of the amplitude of a magnetizing pulsed field H_p on the process of magnetization switching in saturated iron garnet films. The investigation was carried out by the method of high-speed photography. A pulsed field was generated in a planar coil of diameter ~2 mm located on the surface of a sample. In the initial state, a field H_b was used to saturate a sample and H_p was applied antiparallel to H_b. Dynamic domains were observed in the field of a microscope over an area of $\sim 3.10^4\ \mu^2$. (6 refs.)

Extraordinary Hall resistivity in amorphous terbium-iron thin films and its temperature dependence ....See Entry 119546

Magnetic anisotropy of ion-implanted layers in iron garnet films ....
....See Entry 119833

Magnetization reversal in cobalt-phosphorus films ....See Entry 119868

75.70K Domain structure (magnetic bubbles)

119881 Static properties of magnetic bubbles in garnet films with orthorhombic anisotropy. D.J.Breed, W.de Geus (Philips Res. Labs., Eindhoven, Netherlands).
J. Appl. Phys. (USA), vol.54, no.9, p.5314-21 (Sept. 1983).
The static properties of bubbles in (110) oriented garnet films of composition $(Gd, Y)_3(Fe, Mn, Ga)_5O_{12}$ have been studied. The anisotropy in these films is orthorhombic with the easy axis of magnetization perpendicular to the plane of the film and a secondary easy axis in the plane of the film. Two types of bubbles can be distinguished, *A*-type bubbles having no Bloch lines and *B*-type bubbles with Bloch lines. Magnetic fields parallel to the in-plane easy axis of magnetization have a strong influence on the diameter and on the collapse field. Whereas the properties of the *B*-type bubbles are independent of the sign of this in-plane field, the properties of the A-type bubbles do depend on the sign of this in-plane field. *B*-type bubbles easily change state and become A-type under influence of in-plane fields. At zero in-plane field the collapse fields of *B*-type bubbles are about 1 to 3% larger than the collapse fields of *A*-type bubbles. A theory is presented that takes into account the interaction between in-plane field and domain wall magnetization. In this way the experimental data obtained for the *A*-type bubbles are reproduced very well. The difference between the collapse fields of *A*- and *B*-type bubbles in zero in-plane field is explained by taking into account the influence of stray fields and Bloch lines on the domain wall energy. (14 refs.)

119882 Ferromagnetic resonance study of magnetic anisotropy and domain observations in implanted garnets misoriented from (111). H.Niedoba, C.Nourtier, I.B.Puchalska (Lab. de Magnetisme et d'Optique des Solides, CNRS, Meudon, France), P.Gerard.
J. Appl. Phys. (USA), vol.54, no.9, p.5322-30 (Sept. 1983).
The magnetic anisotropy of nonimplanted and implanted layers in garnet films misoriented from (111) has been studied by ferromagnetic resonance (FMR). The measured FMR field orientation dependence is consistent with a phenomenological model taking into account the growth-induced and stress-induced anisotropy contributions. The effective uniaxial anisotropy field $H_K\nabla$, cubic magnetocrystalline anisotropy field H_1, and anisotropy fields proportional to the crystallographic misorientation angle Δ_c:$H_K{}^\delta$ and H_p (orthorhombic anisotropy field) are determined from the resonance field orientation dependence in two different planes. In the implanted layer only two stable equilibrium magnetizations exist. Charged wall motion is consistent with the easy and hard magnetization directions deduced from FMR. (16 refs.)

119883 Domain wall mobility in epitaxial iron garnet films. N.V.Shakhova (M.V. Frunze State Univ., Simferopol, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.530-1 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.920-2 (March 1983). [received: Oct. 1983]
The method developed previously by Abyzov et al. (1979) and Zuev et al. (1980) is used to study magnon dynamic retardation of a plane isolated domain wall moving in an iron garnet film at a low speed V. The domain wall structure is determined by minimizing the energy of the ferromagnet. (4 refs.)

119884 Formation of an array of magnetic bubbles in ferrite garnet films. V.G.Bar'yakhtar, V.L.Dorman, Yu.A.Kuzin, Yu.V.Melikhov, E.F.Khodosov (Physicotech. Inst., Acad. of Sci., Donetsk, Ukrainian SSR).
Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.562-3 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1306-9 (Nov. 1982). [received: Sept. 1983]
Reports a study of the formation of a bubble array from a labyrinthal domain structure in a uniaxial ferrite garnet film under the influence of a periodic train of magnetic field pulses directed parallel to the easy axis. The array formation process was studied by means of the Faraday effect in a magnetooptic apparatus using a polarizing microscope. The pulsed magnetic field was produced by a pair of parallel planar conductors separated by a distance on the order of 400 μm. (9 refs.)

119885 Magnetostatic waves in a magnetic bubble. I.V.Zavislyak.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1403-8 (Sept. 1983). In Russian.
The spectrum of magnetostatic waves has been investigated in a magnetic bubble. It is shown that both surface and bulk magnetostatic waves can propagate along the magnetic bubble. New types of bulk magnetostatic waves are detected. Theoretical results are compared with the experimental data. (16 refs.)

75.80 MAGNETOMECHANICAL AND MAGNETOELECTRIC EFFECTS, MAGNETOSTRICTION

119886 Magnetoelastic dynamics of amorphous ferromagnets. A.Hernando, V.Madurga, M.Liniers (Lab. de Magnetismo, Univ. Complutense, Madrid, Spain).
An. Fis. Ser. A (Spain), vol.79, no.2, p.136-44 (May-Aug. 1983). [received: Oct. 1983]
A study about the dependence of the elastic constants with magnetic applied field in ferromagnetic amorphous ribbons has been carried out. Theory predicts an anomalous and sharp increment for the rigidity modulus originated by irreversible domain wall motion in uniaxial ribbons. The authors report a method to generate magnetically extensional and torsional modes which allowed them to observe this anomalous transition. (17 refs.)

119887 Influence of the torsional elastic strain on the magnetic behaviour in pure polycrystalline nickel. J.M.Gonzalez, V.Madurga, A.Hernando (Lab. de Magnetismo, Univ. Complutense, Madrid, Spain), A.Garcia-Escorial.
An. Fis. Ser. B (Spain), vol.79, no.2, p.77-81 (May-Aug. 1983). [received: Oct. 1983]
A study of the mechanical, magnetic and magnetoelastic behaviour of plastically strained polycrystalline Ni (99.99% purity) is reported. The inverse Wiedemann effect gives a good characterization of the magnetic anisotropy induced by plastic torsion, which has been explained as a consequence of helically distributed residual stresses localized near the wire surface. (15 refs.)

119888 Changes in the remanent magnetisation, magnetoelastic coupling and Young's modulus during structural relaxation of an amorphous ribbon. A.Hernando (Lab. of Magnetism, Univ. Complutense, Madrid, Spain), A.Garcia-Escorial, E.Ascasibar, M.Vazquez.
J. Phys. D (GB), vol.16, no.10, p.1999-2010 (14 Oct. 1983).
The kinetics of structural relaxation have been studied in the amorphous alloy $Fe_{40}Ni_{40}P_{14}B_6$ over the temperature range 230-380°C, by the analysis of the magnetoelastic coupling coefficient, Young's modulus and remanent magnetisation. Measurements provide evidence that different mechanisms should be considered in order to explain the observed behaviour. The results are discussed in terms of different theoretical relaxation models previously reported. Comparison of relaxation data with those predicted from models based on an activation energy spectrum shows an overall consistency. (22 refs.)

119889 The influence of cold-working on magnetic properties in Ni_3Al. S.Takahashi (Faculty of Engng., Iwate Univ., Morioka, Japan), K.Ikeda.
J. Phys. F (GB), vol.13, no.10, p.2169-74 (Oct. 1983).
The application of cold-working causes a remarkable reduction in the magnetisation of the intermetallic Ni_3Al compound. The cold-working effect is explained in terms of the dislocation theory with consideration of the ferromagnetic and paramagnetic interactions of Ni atoms. The magnetisation at 0K decreases in proportion to the dislocation density in the early stage of plastic deformation and to the square root of it in the advanced stage. (7 refs.)

119890 ^{57}Fe Mossbauer effect evidence for magnetostruction in UFe_2. T.K.McGuire, R.H.Herber (Dept. of Chem., Rutgers Univ., New Brunswick, NJ, USA).
Solid State Commun. (USA), vol.48, no.4, p.393-5 (Oct. 1983).
Temperature dependent ^{57}Fe Mossbauer experiments on UFe_2 have shown that above T_c (158K) the logarithm of the recoil-free fraction is a linear function of temperature, with $\theta_M = 325K$. Below T_c there is a non-linear increase in f which is interpreted in terms of a reduction in the mean square amplitude of the iron atom motion assoctiated with magnetostricion of the unit cell. (15 refs.)

119891 The magnetic and magnetoelastic properties of amorphous metallic ribbons. R.Grossinger, H.Sassik, C.Schotzko, A.Veider (Inst. of Experimental Phys., Tech. Univ. of Vienna, Wien, Austria).
Z. Metallkd. (Germany), vol.74, no.9, p.577-84 (Sept. 1983).
Magnetic (hysteresis) and magnetoelastic (*E*-modulus, Δ*E*-effect, magnetostriction, thermal expansion) measuring methods developed for amorphous ribbons are surveyed. Examples of results especially obtained from $Fe_{40}Ni_{40}B_{20}$ are given. The data are discussed with respect to the general aspects of these experiments as well as to varying producing conditions of a conventional melt spinning technique. (36 refs.)

Magnetoelastic plane waves in infinite rotating media ....See Entry 118489

Stress dependence of magnetically induced ultrasonic shear wave velocity change in polycrystalline A-36 steel ....See Entry 119111

Magnetoacoustic excitation of coherent spin waves in antiferromagnets ....
....See Entry 119829

Reversibility of phase transition of antiferromagnetic $CoCl_2.6H_2O$ under hydrostatic pressure ....See Entry 119836

Influence of uniaxial pressure on the Neel temperature of antiferromagnet $CuCl_2.2H_2O$ ....See Entry 119846

76.00 MAGNETIC RESONANCES AND RELAXATION IN CONDENSED MATTER; MÖSSBAUER EFFECT

(for measurement techniques, see 07.58)

76.20 GENERAL THEORY OF RESONANCES AND RELAXATION

119892 Magnetic resonance in a solid subjected to a nonmonochromatic saturating field. M.I.Rodak (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.500-2 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.874-7 (March 1983). [received: Oct. 1983]
The field causing saturation in magnetic resonance is usually assumed to be monochromatic at a frequency $\omega = \omega_0 + \Delta$, where ω_0 is the center of the magnetic resonance line ρ_0 (Δ). Only special cases of deviations from monochromatic behavior have been considered, i.e. the case of fast modulation of the field and the case of two stationary fields. The author treats the general case of nonmonochromatic fields. The approach is based on the approximation of Goldman (1970) and others. It corresponds to a simple superposition of the actions of fields of different frequencies. (7 refs.)

76.30 ELECTRON PARAMAGNETIC RESONANCE AND RELAXATION

119893 Spin dynamics and soliton motion in trans-$(CH)_x$. M.Nechtschein, F.Devreux, F.Genoud, M.Guglielmi, K.Holczer (Dept. de Recherche Fondamentale, CENG, Grenoble, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.209-16 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Magnetic resonance data in undoped trans-$(CH)_x$, including nuclear and electron relaxation times (T_1, and T_{1e}), ESR linewidth, and dynamic nuclear polarization are reviewed and analyzed. The results are comprehensively

explained in terms of highly one dimensional diffusive spins, the properties of which are consistent with the soliton picture, provided that trapping effects are taken into account. At a given temperature, the population of the spins in the trapped state depends on two parameters: the trap-site concentration and the trapping energy. These parameters are evaluated from the temperature dependence of both the ESR linewidth and T_1. The authors also give experimental determination of the diffusion coefficient as a function of temperature and of the soliton extension. (21 refs.)

119894 Magnetic properties. I. Electronic T_2 and T_1 in undoped $(CH)_x$ and $(CD)_x$. N.S.Shiren (Univ. of Lancaster, Lancaster, England), Y.Tomkiewicz, H.Thomann, L.Dalton, T.C.Clarke.
J. Phys. Colloq. (France), vol.44, no.C-3, p.223-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors have measured the magnitude and temperature dependences of T_{2e} and T_{1e} in undoped polyacetylene. The T_{2e} measurements and the determination of soliton diffusion rates from them are summarised. New T_{1e} measurements on $(CD)_x$ and $(CH)_x$ at 9.5 GHz and 16.7 GHz are presented. These measurements are utilised to compute nuclear spin relaxation times, T_{1p}, via the mechanism of nuclear spin diffusion to fixed paramagnetic impurities. It is shown that the results of this calculation agree with published NMR measurements at least as well as does the soliton diffusion model. (8 refs.)

119895 Electron spin motion in trans-$(CH)_x$. W.G.Clark, K.Glover, G.Mozurkewich, C.T.Murayama, J.Sanny, S.Etemad, M.Maxfield (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.239-45 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Electron and nuclear magnetic relaxation measurements are reported for undoped trans-$(CH)_x$ between 0.035K and 300K. They are interpreted in terms of the translational and orientational motion of the electron spins. Evidence is presented to show that previously reported large soliton diffusion constants are incorrect. (19 refs.)

119896 ESR and conductivity studies of doped polyacetylene. D.Davidov, S.Roth (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany), W.Neumann.
J. Phys. Colloq. (France), vol.44, no.C-3, p.295-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The temperature, doping and microwave power dependence of ESR spectra of polyacetylene doped with AsF_5 or SbF_5 is studied. Coexistence of two types of spins is found in all but the most heavily doped samples. The superimposed ESR lines differ in shape and width, temperature dependence and relaxation time. They are attributed to localized and itinerant spins, respectively. These results are indicative of sample inhomogeneities (at least on a microscopic level). (9 refs.)

119897 Distribution of spin density in undoped $(CH)_x$. S.Kuroda (Electrotech. Lab., Ibaraki, Japan), M.Tokumoto, N.Kinoshita, T.Ishiguro, H.Shirakawa.
J. Phys. Colloq. (France), vol.44, no.C-3, p.303-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
ESR spectra of immobile solitons in undoped polyacetylene were computer simulated using theoretical spin densities and the anisotropic hyperfine interaction of π-electron. Simulated results were consistent with observed spectra of cis-rich sample when the spin densities derived for finite on-site Coulomb energy were used. (12 refs.)

119898 ESR study during the electrochemical n-type doping of $(CH)_x$. P.Bernier, A.El-Khodary, F.Rachdi (Groupe de Dynamique des Phases Condensees, Univ. de Sci. et Technol. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.307-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors present and discuss some preliminary results concerning the EPR study during the electrochemical Li^+ doping of cis rich (CH_x) films. With low doping levels ($<10^{-3}$ molar) they observe a continuous decrease of the unpaired electrons number while the EPR linewidth does not change. These results are interpreted in term of preferential doping of the trans parts of the polymer. (5 refs.)

119899 An in situ EPR study of electrochemically doped trans polyacetylene. L.D.Kispert (Chem. Dept., Univ. of Alabama, Tuscaloosa, AL, USA), J.Joseph, T.V.Jayaraman, L.W.Shacklette, R.H.Baughman.
J. Phys. Colloq. (France), vol.44, no.C-3, p.317-20 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
An in situ EPR study has been carried out during repeated charge/discharge cycles of a battery consisting of trans polyacetylene (PA) as the cathode and Li/Al alloy as the anode. The detected spin concentration reversibly ratio decreased with each repeated cycle for ClO_{4-} in ratio decreased with each repeated cycle for ClO_4^- in propylene carbonate and BF_4^- in sulfolane as the dopants. While this decreasing A/B ratio is consistent with decreasing conductivity in the doped state, the observed invariance of ESR linewidth before and after doping suggests that massive disruption of chain conjugation does not occur during battery cycling. (8 refs.)

119900 Formation of fixed paramagnetic solitons in a polyacetylene analogue polymer matrix: ESR studies in thermally decomposed PVC. G.Vancso, T.T.Nagy, B.Turcsanyi, T.Kelen, F.Tudos (Central Res. Inst. for Chem., Hungarian Acad. of Sci., Budapest, Hungary).
J. Phys. Colloq. (France), vol.44, no.C-3, p.701-4 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors present experimental results concerning estimation of SSH paramagnetic soliton width in a polyacetylene analogue polymer. (10 refs.)

119901 Excited triplet state EPR of sigma-bonded TCNQ dimers in $[Cu(DMP)_2]_2[TCNQ]_2$. W.E.Hatfield, S.K.Hoffmann, P.J.Corvan, P.Singh, C.N.Sethulekshmi, R.M.Metzger (Dept. of Chem., Univ. of North Carolina, Chapel Hill, NC, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1377-80 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
$[Cu(DMP)_2]_2[TCNQ]_2$ contains chains of sigma-bonded dianionic dimers of TCNQ, $[TCNQ]_2^{--}$, with low interdimer overlap. Thermal excitation (E_a=0.55 eV) breaks this long (1.630(13) Å) and weak bond. The resultant two $TCNQ^-$ radicals (S=1 state) yield a Frenkel triplet spin exciton spectrum, whose fine structure parameters are well accounted for by a theoretical calculation. Exciton motion is sufficient to eliminate the hyperfine structure. (17 refs.)

119902 Photogeneration of solitons in trans-$(CH)_x$: the reversed spin-charge relation of the photoexcitations. J.D.Flood, A.J.Heeger (Inst. for Polymers & Organic Solids, Univ. of California, Santa Barbara, CA, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2356-60 (1 Sept. 1983).
High-sensitivity ESR studies of trans-$(CH)_x$ have been carried out during photoexcitation with $\hbar\omega > E_g$. The results set an upper limit on the number of photoinduced unpaired spins, which is more than two orders of magnitude smaller than the number of charged excitations photogenerated under the same experimental conditions. The authors conclude that the charged photoexcitations are spinless and therefore have the reversed spin-charge relation of solitons. The photogeneration branching ratio, neutral solitons to charged solitons, is less than 10^{-2}. (35 refs.)

A new series of radical cation salts: the trimethylenetetrathia-fulvalenium pseudo halides salts ($tTTF_2$-X′) .... See Entry 118996

Radical-cation salts of substituted perylenes .... See Entry 118997

Electrocrystallisation and physical properties of dimethyltetrathia-fulvalenium salts .... See Entry 118998

Triplet excitons in $MEM(TCNQ)_2$ .... See Entry 119459

A theoretical analysis of electron Zeeman and hyperfine tensors for polyacetylene .... See Entry 119529

Synthesis and physical properties of dimethyl trimethylene tetrathia-fulvalenium salts .... See Entry 119539

Conducting cation-radical salts based on DBTTF and its selenium analogue, DBTSF .... See Entry 119579

Photogeneration of solitons in trans-$(CH)_x$: the reversed spin-charge relation of the photoexcitations .... See Entry 119654

Physical properties of the TMTTF salts and TMTSF/TMTTF alloys: competition between the stacks instabilities .... See Entry 119810

Magnetic sub-chain anisotropy in the crossing chain compound $HMM(TCNQ)_2$ .... See Entry 119811

Magnetic study of the phase transitions in $(TMTTF)_2X$ salts .... See Entry 119839

High resolution NMR and time resolved ESR on polyacetylene .... See Entry 119925

Magnetic properties of polyacetylene composites [ENDOR and electron spin echo studies] .... See Entry 119951

Doping and degradation of polyacetylene by nitric acid .... See Entry 120054

Formation of highly conducting derivatives of polyacetylene through oxidation with selected metal halides .... See Entry 120298

76.30D Ions and impurities: general

119903 The ESR linewidth of dilute solid solutions. R.S.de Biasi, A.A.R.Fernandes (Centro de Pesquisa de Materiais, Inst. Militar de Engenharia, Rio de Janeiro, Brazil).
J. Phys. C (GB), vol.16, no.28, p.5481-9 (10 Oct. 1983).
A theoretical study of the broadening of magnetic resonance lines due to the dipole interaction in dilute solid solutions of paramagnetic impurities in diamagnetic hosts is presented. The theory takes into account the exchange interaction between impurity ions. Detailed results are presented for the three cubic lattices. The theoretical results are compared with experimental data on Cr^{3+}:MgO powders. (15 refs.)

76.30F Iron group (3d) ions and impurities (Ti-Cu)

119904 The isotropic hyperfine interaction in ternary complexes of copper(II) with 8-hydroxyquinoline and various salicyclic acids. Y.Anjaneyulu, N.V.S.Rao, R.Y.Swamy, R.P.Rao, V.G.K.M.Pisipati (Nagarjuna Univ., Nagarjunanagar, India).
Can. J. Chem. (Canada), vol.61, no.9, p.2154-8 (Sept. 1983).
Electron spin resonance and optical absorption studies are carried out on bis(8-hydroxyquinolinato)copper(II) and seven ternary copper(II) complexes with 8-hydroxyquinoline and salicylic acid or substituted salicylic acids. Electron spin resonance spectra of all these complexes give well-resolved lines. An unusual splitting of the parallel lines in frozen solution spectra and four line fluid (DMF) solution spectra at room temperature are observed. It is explained on the basis of either partial dissociation of 8-hydroxyquinoline ligand or the solvation effect of DMF which solvates some copper chelate molecules even at room temperature. This is more prominent on the parallel lines in frozen solution spectra of all the ternary complexes. The molecular orbital coefficients are estimated assuming an axial symmetry and these indicate that the in-plane π bonding is weak compared to σ-bond in the ternary complexes. The value of χ, which is proportional to hyperfine constants, indicates that it is quite independent of either ligand substitutions or substitutions in the ligand, but purely depends upon the immediate environment which constitutes the coordination around the paramagnetic ion. (16 refs.)

119905 Paramagnetic resonance and optical absorption of Co^{4+} in $SrTiO_3$. K.W.Blazey, K.A.Muller (IBM Zurich Res. Lab., Ruschlikon, Switzerland).
J. Phys. C (GB), vol.16, no.28, p.5491-502 (10 Oct. 1983).
The paramagnetic resonance of low-spin Co^{4+}, $3d^5$ in the oxygen octahedral coordination of $SrTiO_3$ at 4.2K is reported. The spectrum is described by a spin-Hamiltonian with $S={}^1/_2, |\bar{g}|=|g_\parallel+2g_\perp|/3=1.7414\pm0.0015$, and a large hyperfine interaction constant $|A|=|A_\parallel+2A_\perp|/3=254\pm8\times10^{-4}$ cm^{-1}. Correlated with this centre is an optical absorption band at 2.53 eV. This band is attributed to electron-acceptor charge transfer from the oxygen 2p valence states to the $t_{2g}(\downarrow)$ levels of the Co^{4+}. The EPR and optical results are analysed using theoretical expressions due to Thornley (1968), from which

an orbital reduction factor of $k=0.64\pm0.04$ and an average radial electron distribution, $\langle r^{-3}\rangle$, reduced by a factor 0.67 ± 0.06 with respect to the free ion are derived. These significant reduction factors appear to be partly due to a weak dynamic Jahn-Teller effect. The slight tetragonality of the spectrum is a measure of the coupling, $p_2/\mu_e=|g_{\perp}\text{-}g_{\parallel}|/3\epsilon=2.14\times10^2$, to the intrinsic tetragonal distortion of the crystal. The charge linewidth anisotropy is also accounted for by this coupling to E_g random strains with a distribution $\alpha=126$ kg cm^{-2}. (28 refs.)

119906 Optical and ESR investigations of lanthanum aluminates $LaMg_{1-x}Mn_xAl_{11}O_{19}$ single crystals with magnetoplumbite-like structure. F.Laville, D.Gourier, A.M.Lejus, D.Vivien (ENSCP, Paris, France).
J. Solid State Chem. (USA), vol.49, no.2, p.180-7 (Sept. 1983).
New lanthanum aluminates $LaMAl_{11}O_{19}$ (M^{2+}=Ni, Co, Mn, $Mg_{1-x}Mn_x$, $0\leq x\leq1$), with magnetoplumbite-like structure have been obtained as single crystals. This paper is particularly devoted to the Mn^{2+} and Mg^{2+}/Mn^{2+} mixed compounds, which exhibit promising luminescent properties. Several characteristics of the crystals are given. The absorption spectra of the materials, as grown, are assigned to Mn^{2+} ions in tetrahedral sites. After annealing in air new absorptions attributed to octahedral Mn^{3+} ions, appear. The ESR spectra of Mn^{2+} ions in all these crystals exhibit axial symmetry. For $x\leq0.25$ they arise from isolated Mn^{2+} ions in slightly distorted tetrahedral sites and reveal a strong disorder effect. For $x\geq0.5$ the spectra consist of a single line, attributed to clusters of magnetically interacting Mn^{2+} ions. (29 refs.)

119907 Interchain interactions in the highly one dimensional tetraethyl ammonium bis(maleonitrile dithiolato) nickelate, NEt_4 Ni mnt_2. B.L.Ramakrishna, P.T.Manoharan (Dept. of Chem., Indian Inst. of Technol., Madras, India).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1405-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
'Magnetic dilution' achieved through strong antiferromagnetic interchain exchange leads to sharp lines in EPR, which enables the resolution of extremely small fine structural details. These have been shown to be due to interchain dipolar interactions which are modulated by weak interchain exchange coupling. (5 refs.)

Ln_2BaZnO_5 and $Ln_2BaZn_{1-x}Cu_xO_5$: A series of zinc oxides with zinc in pyramidal coordination ....See Entry 118978

Strong electron-phonon interaction in quasi-one-dimensional conductor $M_xV_2O_5$ systems ....See Entry 119589

The ESR linewidth of dilute solid solutions ....See Entry 119903

76.30H Platinum and palladium group (4d and 5d) ions and impurities (Zr-Ag and Hf-Au)

Superhyperfine interactions of A_F centers in alkali halide crystals ....See Entry 119015

76.30K Rare-earth ions and impurities

119908 Paramagnetic impurity centers in single crystals of synthetic xenotime. M.V.Samatov, S.L.Votyakov, A.A.Krasnobaev (A.N. Zavaritskii Inst. of Geology & Geochem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1604-6 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1866-8 (Nov. 1982).
Single crystals of xenotime have been synthesized from Y_2O_3 solution in a melt of the system $Na_4P_2O_7$-MoO_3. Their EPR spectra have been investigated in the X and Q bands. The radiation-induced paramagnetic centers Zr^{3+} and Hf^{3+} are found and interpreted, and their temperature stability is studied. They are compared with analogous centers in zircon. It is shown that there is a difference in the interaction of the $4d^1$ and $5d^1$ configurations with the crystal fields of the isostructural compounds xenotime and zircon. (8 refs.)

119909 EPR and ionic thermocurrents experiments on cubic solid solutions $Sr_{1-x}Eu_xF_{2+x}$. H.W.den Hartog (Solid State Phys. Lab., Univ. of Groningen, Groningen, Netherlands), R.Nakata.
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3110-21 (Sept. 1983).
The authors report the results of EPR and ionic thermocurrents (ITC) experiments on cubic solid solutions of the type $Sr_{1-x}Eu_xF_{2+x}$. A part of the Eu-ions is in the divalent state; these ions can be detected easily with EPR. From the EPR results they conclude that for $0\leq x\leq0.115$ the long range order is still cubic and the lattice parameter does not vary appreciably. The interactions between distant Eu^{3+}-F_1^- dipoles and the Eu^{2+} probes is estimated; from this the authors conclude that for $x\gtrsim0.044$ clustering of trivalent Eu-ions cannot be excluded. The ITC results are in line with those obtained from EPR. In addition they note that for small values of x nearest neighhor (NN) Eu^{3+}-F_1^- complexes are the dominant defects. For $x>5\times10^{-3}$ NNN dipoles are present also. Apart from the reorientation bands associated with the above-mentioned defects they observe with ITC a depolarization peak, ascribed to space charge phenomena. The behavior of the dipole peaks and the space charge peak is discussed together with the conduction processes in concentrated solid solutions of $Sr_{1-x}Eu_xF_{2+x}$. (31 refs.)

Influence of the disorder potential of the anions on the ground state of the organic alloy $(TMTSF)_2(ClO_4)_{1-x}(ReO_4)_x$ ....See Entry 118994

$(ReO_4)^{2-}$ ion in KCl: experimental evidence for a multimode intramolecular Jahn-Teller effect ....See Entry 119526

Dilemma of $EuMo_6X_8$ (X=S, Se)—possible solution ....See Entry 119734

76.30L Other ions and impurities

(for colour centres, see 76.30M)

119910 Different kinds of Tl^{2+} charge compensation in thallium doped KH_2PO_4 and KD_2PO_4 crystals. L.V.Gonzaga, J.F.Sampaio, G.M.Ribeiro, R.Gazzinelli, A.S.Chaves (Dept. of Phys., Univ. Federal de Minas Gerais, Belo Horizonte, Brazil).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3215-18 (Sept. 1983).
Three different kinds of charge compensation for Tl^{2+} are observed in the paraelectric phase of heavily doped KH_2PO_4 and KD_2PO_4. The EPR spectra of two of these paramagnetic centers, not yet reported in the literature, are studied and possible models for the charge compensation are proposed.

119911 ESR study of oxygen trapping in trans-$(CH)_x$. F.Genoud, F.Devreux, M.Nechtschein, J.P.Travers (Dept. de Recherche Fondamentale, CENG, Grenoble, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.291-4 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Studies the kinetics of oxygen adsorption in trans-$(CH)_x$ by following the decrease of the spin number as measured by ESR as a function of oxygen pressure and temperature. (3 refs.)

119912 Magnetic resonance studies on iodine doping of polyacetylene. M.Tokumoto, N.Kinoshita, S.Kuroda, T.Ishiguro (Electrotech. Lab., Ibaraki, Japan), H.Shirakawa, H.Nemoto.
J. Phys. Colloq. (France), vol.44, no.C-3, p.299-302 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The effect of iodine doping on the spin concentration of trans-$(CH)_x$ was studied at various doping levels monitored by the conductivity increase. Competition between two types of soliton doping mechanism was found to vary with iodine concentration. (4 refs.)

119913 Electron spin echo determination of spin diffusion in the one-dimensional conductor $(\text{fluoranthenyl})_2{}^+(PF_6)_x{}^-(SbF_6)_{1-x}{}^-(x\approx0.5)$. J.Sigg, Th.Prisner, K.P.Dinse, H.Brunner, D.Schweitzer, K.H.Hausser (Max-Planck-Inst., Heidelberg, Germany).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1421-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
From the electron spin echo decay function of $(Fa_2)^+X^-$ a ratio of $5.10^6\leq D_{\parallel}/D_{\perp}\leq5.10^8$ for the inner stack to out-of-stack diffusion rates was determined. The deduced value of $2.10^{13}\leq D_{\parallel}\leq2.10^{16}$ rad s^{-1} is consistent with the bulk DC-conductivity of $\sigma=10$-100 $(\Omega\text{cm})^{-1}$. (10 refs.)

119914 Structure and kinetics of some paramagnetic oxygen centres in synthetic calcium fluoride crystals. W.Karthe, H.-J.Fuchs (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.125-32 (1983). In English.
Structure and kinetics of several oxygen centres in synthetic calcium fluoride crystals were investigated by means of electron paramagnetic resonance (EPR) and electron nuclear double resonance (ENDOR). In crystals doped with manganese or yttrium ions was studied the conversion of paramagnetic centres as consequence of additional oxygen doping. The type of metal-oxygen centre depends on the conversion conditions (temperature air pressure during temperature treatment). The kinetics was investigated after X-irradiation, thermal and optical bleaching of the centres. In undoped CaF_2 crystals oxygen centres were generated by a diffusion process in air and by subsequent X-irradiation. At 77K the X-irradiation generates V_K-type centres stabilized by oxygen. These V_K-type centres are destroyed at 150K and an oxygen-fluorine vacancy centre occurs. At room temperature this centre is generated directly by X-irradiation. The kinetics of the centre was studied. A model is suggested. The diffusion profile of oxygen in CaF_2 was determined from the distribution of these centres. The activation energy for the oxygen diffusion amounts to $E_A\approx1.8$ eV. The diffusion processes in the crystals doped with metal ions were found to be different from diffusion in undoped crystals. (22 refs.)

n-type doping of $(CH)_x$: molecular diffusion of the dopant .....See Entry 119273

Polyacetylene: the search for solitons ....See Entry 119554

Amorphous silicon-phosphorus layer ....See Entry 119613

The influence of thermal history on the microstructure of sulfonated polystyrene ionomers ....See Entry 120354

76.30M Colour centres and other defects

119915 ESR of electron-excess centres in X-irradiated $3CdSO_4.8H_2O$ and $(NH_4)_2SO_4$:Cd crystals. C.S.Sunandana (School of Phys., Univ. of Hyderabad, Hyderabad, India), C.Ramasastry.
Spectrochim. Acta Part A (GB), vol.39A, no.9, p.781-5 (1983).
An ESR study of X-irradiated $3CdSO_4.8H_2O$ and cadmium-doped $(NH_4)_2SO_4$ single crystals at 300K has revealed the presence of an electron-excess centre, trapped at two physically inequivalent sites in the former and at a single site in the latter. The nature of this centre is discussed with the aid of optical spectra. Also, other hole-type centres are characterized in the two systems. (18 refs.)

Superhyperfine interactions of A_F centers in alkali halide crystals ....See Entry 119015

Intrinsic defects of TiO_2 (110): Interaction with chemisorbed O_2, H_2, CO, and CO_2 ....See Entry 119347

Structure and kinetics of some paramagnetic oxygen centres in synthetic calcium fluoride crystals ....See Entry 119914

Luminescence and magnetic resonance in post-hydrogenated microcrystalline silicon ....See Entry 120147

76.30P Conduction electrons

Low field ESR in the superconducting relaxed state of $(TMTSF)_2ClO_4$ at low temperature ....See Entry 119756

76.30R Free radicals

119916 Electron spin resonance studies of magnetic defects in $FeCl_3$-doped polyparaphenylene (p-C_6H_4)x. P.Kuivalainen (Dept. of Electrical Engng., Helsinki,, Univ. of Technol., Espoo, Finland), H.Stubb, P.Raatikainen, C.Holmstrom.
J. Phys. Colloq. (France), vol.44, no.C-3, p.757-60 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
ESR spectra of $FeCl_3$-doped $(C_6H_4)_x$ have been studied. The concentration of Curie-law spins, T-dependence of the linewidth and a shift in the g-factor due to doping are accounted for by polaron and bipolaron formation in doped samples. In heavily doped material high Fe^{3+} spin densities with broad linewidths were found. (10 refs.)

Electrochemical and ESR studies of 5,6:11,12-bis(dichalcogeno) tetracenes and their cation radicals ....See Entry 117898

Electrical and magnetic properties of poly p-azophenylene ....See Entry 119562

Thermodynamic aspects of mechanical behavior of glassy polymers ....See Entry 120366

EPR and IR investigation on cis-trans isomerization and oxidation of polyacetylene films ....See Entry 120614

76.40 DIAMAGNETIC AND CYCLOTRON RESONANCES

119917 Cyclotron anomaly in 2-D conductors. A.Ishihara, M.Mukai (Dept. of Phys., State Univ. of New York, Buffalo, NY, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1449-52 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
In agreement with recent experiments, the authors show theoretically that the filling factor, rather than the density itself, plays a crucial role for characterizing cyclotron resonance of 2-D conductors. They explain anomalous line broadening and shifting of the absorption line that cannot be explained in terms of single electron theory. (7 refs.)

119918 Shifted cyclotron resonance in $NbSe_3$. R.J.Wagner, N.P.Ong (Naval Res. Lab., Washington, DC, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1697-9 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The cyclotron resonance of free carriers in $NbSe_3$ at 2K has been observed at far infrared frequencies. The effective masses of the two bands are 0.18 and 0.71 times the free mass. A shifted resonance is seen when the electric field polarisation is perpendicular to the chain axis. The authors suggest that this is due to coupling between the free carriers and the pinned Froehlich mode. (3 refs.)

119919 Bistable cyclotron resonance in semiconductors. A.Elci (Dept. of Phys. & Astron., Univ. of New Mexico, Albuquerque, NM, USA), A.E.Kaplan.
Phys. Lett. A (Netherlands), vol.97A, no.7, p.305-8 (12 Sept. 1983).
The authors consider the cyclotron resonance in a semiconductor which has a band with a relativistic energy-momentum dispersion and show that, when subject to quasiresonant radiation, the energy of a free carrier in this band and the relative potential drop between the two surfaces of the semiconductor facing the radiation exhibit bistability under classical single electron approximation. (14 refs.)

119920 Nonlinear effects in bismuth under cyclotron resonance conditions. V.S.Edel'man (Inst. of Phys. Problems, Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.6, p.1343-4 (Dec. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.6, p.2317-19 (Dec. 1982). [received: Oct. 1983]
It is shown that the magnetic-field dependence of the power of a double-frequency (2ω) signal generated when bismuth crystals are irradiated by an intense monochromatic signal of frequency ω, observed by Gantmakher et al. (ibid., vol.55, p.921, 1982), can be ascribed to the dependence of the impedance Z_ω on the magnetic field strength. (8 refs.)

Electron cyclotron absorption in *n*-InSb ....See Entry 119406

76.50 FERROMAGNETIC, ANTIFERROMAGNETIC, AND FERRIMAGNETIC RESONANCES; SPIN WAVE RESONANCE

(see also 75.30D Spin waves)

119921 Properties of ferrimagnetic echoes in yttrium iron garnet cylinders. F.Bucholtz, D.C.Webb (Electronics Technol. Div., Naval Res. Lab., Washington, DC, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5331-8 (Sept. 1983).
The first detailed study of the properties of ferrimagnetic echoes in cylinders of yttrium iron garnet has been performed. Data are presented showing the dependence of the echo on applied field H_a, pulse separation τ, signal pulse power P_s, and pump pulse power P_p. At a given frequency, echoes are found to occur in multiple, well-defined regions of the parameters τ and H_a. For low P_s and P_p, the echo power P_e increases linearly with increasing P_s but increases very rapidly with increasing P_p, following $P_e \sim {P_p}^{4.5}$. P_e saturates at high power levels with the saturation level depending on both P_s and P_p. Additional experimental observations, which give further insight into the excitation and evolution of the echo, are also presented. Experimental results verify some of the qualitative predictions of various models previously proposed for the ferrimagnetic echo process but also point out some of the limitations of these models. (23 refs.)

Origin of antiferromagnetic ordering in Bechgaard salts ....See Entry 119838

Magnetic study of the phase transitions in $(TMTTF)_2X$ salts ....See Entry 119839

Interface magnetism of Fe-Sb multilayered films with artificial superstructure from ^{57}Fe and ^{121}Sb Mossbauer spectroscopy, neutron diffraction and FMR experiments .... See Entry 119879

Ferromagnetic resonance study of magnetic anisotropy and domain observations in implanted garnets misoriented from (111) ....See Entry 119882

Ferromagnetic resonance and magnetic properties of ALHA 81005 ....See Entry 121620

76.60 NUCLEAR MAGNETIC RESONANCE AND RELAXATION

119922 Heteronuclear correlation spectroscopy in rotating solids. P.Caravatti, L.Braunschweiler, R.R.Ernst (Lab. fur Phys. Chem., Eidgenossische Tech. Hochschule, Zurich, Switzerland).
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.305-10 (16 Sept. 1983).
Coherence transfer by an isotropic mixing process is used for two-dimensional heteronuclear shift correlation in magic-angle-spinning solid-state spectroscopy. Selective coherence transfer is combined with efficient homonuclear and heteronuclear dipolar decoupling to obtain well-resolved shift correlation spectra. (21 refs.)

119923 ^{13}C NMR of crystalline morphine. J.G.Hexem, M.H.Frey, S.J.Opella (Dept. of Chem., Univ. of Pennsylvania, Philadelphia, PA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5717-19 (7 Sept. 1983).
The high-resolution ^{13}C NMR spectrum of crystalline morphine obtained with magic angle sample spinning and proton decoupling has resolved resonances from each of the 17 carbon atoms in the molecule. Four of these resonances are split into doublets. The three asymmetric doublets arising from the three carbons bonded to the ^{14}N of the molecule enabled the determination of a value of -1.5 MHz for the nitrogen quadrupole coupling constant. The resonance from C15 is split nearly symmetrically, suggesting that this site exists in two environments. (24 refs.)

119924 Deuteron magnetic resonance study of single crystals of $NaDSeO_3$. I.S.Vinogradova (L.V. Kirensky Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
J. Solid State Chem. (USA), vol.49, no.2, p.129-33 (Sept. 1983).
A deuteron magnetic resonance study of a single crystal of $NaDSeO_3$ at room temperature is reported. The observed electric field gradient tensors correspond to two nonequivalent hydrogen bonds. The quadrupole coupling constants (eQq/h) and asymmetry parameters (η) are found to be 172.8 and 0.07 kHz for D(1), and 152.5 and 0.08 kHz for D(2). D(2) are ordered, but D(1) are found to be dynamically disordered. The DMR results are consistent with recent X-ray reinvestigation. No phase transitions have been encountered in the temperature range 336 to 77K. (9 refs.)

119925 High resolution NMR and time resolved ESR on polyacetylene. M.Mehring (Phys. Inst. 2, Univ. Stuttgart, Stuttgart, Germany), H.Seidel, H.Weber, G.Wegner.
J. Phys. Colloq. (France), vol.44, no.C-3, p.217-22 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Time resolved ESR (spin-echo, saturation recovery) and NMR (magic angle sample spinning, cross polarization and magic echo) experiments are reported on polyacetylene. Three different types of defects were identified: mobile spins (neutral solitons), fixed distributed spins (pinned solitons or polarons) and chain defects. (16 refs.)

119926 ^{13}C NMR studies of iodine doped polyacetylene. I.Heinmaa (Inst. of Chem. Phys. & Biophys., Acad. of Sci., Tallinn, USSR), M.Alla, A.Vainrub, E.Lippmaa, M.L.Khidekel, A.I.Kotov, G.I.Kozub.
J. Phys. Colloq. (France), vol.44, no.C-3, p.357-10 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Natural abundance ^{13}C NMR experiments using cross-polarization and magic angle spinning are reported for cis- and trans-polyacetylene as a function of iodine doping level. Two new signals appearing on doping are attributed to the formation of spinless charged solitons and the chemical addition of iodine to double bonds. Substantial cis/trans isomerization does not occur even at high iodine doping levels. (13 refs.)

119927 Nutation NMR studies of polyacetylene. T.C.Clarke, R.D.Kendrick, C.S.Yannoni (IBM Res. Lab., San Jose, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.369-72 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Using nutation NMR spectroscopy the authors have been able to determine directly the carbon-carbon bond lengths in polyacetylene. For trans-polyacetylene they find double and single bond lengths of 1.36 and 1.44 Å respectively; the double bond in cis-polyacetylene is found to be 1.38 Å. Interestingly, at 77K they do not observe a rapid interchange of the single and double bonds in trans-polyacetylene in the manner predicted for chains containing a soliton defect, suggesting that the majority of the carbons in the trans isomer are on conjugated segments which do not contain such mobile species. (13 refs.)

119928 ^{93}Nb NMR study of $NbSe_3$. F.Devreux (Dept. de Recherche Fondamentale, CENG, Grenoble, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1665 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
High field NMR measurements provide new and detailed information on the electronic structure of $NbSe_3$. (no refs.)

119929 ^2H-NMR spectral patterns in magneto-aligned smectic E and G phases. R.Y.Dong, H.Schmiedel, N.A.P.Vaz, Z.Yaniv, M.E.Neubert, J.W.Doane (Dept. of Phys., Kent State Univ., Kent, OH, USA).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.411-24 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Unique ^2H-NMR spectral patterns can be obtained from biaxially ordered smectic *E* and *G* phases, where only one director of the phase is aligned by the magnetic field. Two effects on the shape of the deuterium spectral pattern are demonstrated: (1) The effect of a motionally induced asymmetry parameter in the time averaged deuterium quadrupole interaction, and (2) the effect when the principal *z*-axis of the time averaged interaction is not parallel to the aligned director. Spectral patterns for the S_G phase of the compound 4-*n*-pentoxybenzylidene-4-*n*′-heptylaniline selectively deuterated on one of the aromatic rings (5o.7-d_4) were obtained for both unaligned and magneto-aligned samples. Spectral patterns were also recorded for the S_E phase in magneto-aligned samples of the mixture of compounds 4-cyano-4′-octyloxybiphenyl (8oCB) with 50 wt.% 4o.8-d_4. Models for the smectic *E* and *G* phases based on these observations are discussed. (15 refs.)

119930 High resolution solid state ^{13}C NMR of butadiene grafted polypropylene. P.F.Barron, W.K.Busfield, T.Morley-Buchanan (School of Sci., Griffith Univ., Nathan, Queensland, Australia).
Polymer (GB), vol.24, no.10, p.1252-4 (Oct. 1983).
^1H dipolar decoupled ^{13}C NMR experiments with the aid of the magic angle spinning technique have been used to determine the graft content and the isomer content of the polybutadiene grafts in a graft copolymer with isotactic polypropylene. (5 refs.)

119931 Local boron environment in $Ni_{100-x}B_x$ metallic glasses: an NMR study. P.Panissod, I.Bakonyi (Univ. Louis Pasteur, Strasbourg, France), R.Hasegawa.
Phys. Rev. B (USA), vol.28, no.5, p.2374-81 (1 Sept. 1983).
From the analysis of the ^{11}B NMR spectra in *a*-$Ni_{100-x}B_x$ ($18.5 \leq x \leq 40$) the electric-field-gradient (EFG) components on the B sites and their distributions are deduced, giving an insight into the local atomic arrangements. For $x=18.5$ and 40, one finds relatively narrow distributions of the EFG components, indicating weak fluctuations of the bonding angles, distances, and

nature of the atoms in the B coordination shell. The comparison with the compositionally closest nickel borides (Ni_3B and Ni_4B_3) immediately suggests that the local structure around B is similar in these glasses and in the related crystals, i.e. nickel trigonal prisms (6 Ni) whose rectangular faces are capped by 3 Ni (Ni_3B) or 3 Ni and/or B (Ni_4B_3). For intermediate concentrations the EFG component distributions are found significantly broader and comparable with those expected from random packing of spheres. However, the continuous evolution of the NMR spectra shape with increasing B content rather suggests an admixture of c-Ni_3B-like and c-Ni_4B_3-like B local environment; i.e. when B concentration increases, more prisms share rectangular faces allowing boron-boron contact as in c-Ni_4B_3. No sign of a B coordination shell similar to that in c-Ni_2B (8 Ni anticubes+2 B) is found in the glasses. Measurements of transverse relaxation times T_2, which reflect essentially the B-B bondings, qualitatively support these conclusions. (11 refs.)

119932 Change in the profile of the free induction signal during establishment of a spin temperature. A.S.Maslennikov, R.A.Dautov, Yu.L.Popov, V.S.Skrebnev (V.I. Ulyanov-Lenin State Univ., Kazan, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.419-21 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR),* vol.25, no.3, p.734-7 (March 1983). [received: Oct. 1983]
During the time of establishment of a spin temperature in a rotating system of coordinates, a change in the profile of the free induction signal of nuclear spins was observed after a weak RF field had been switched off. Such a change in the profile during short times of the evolution of the system in a rotating system of coordinates is explained using an expansion of the solution of the Liouville equation for the density matrix in powers of a small parameter. The behavior of the system after a long time (when an internal equilibrium is reached) is described well by a spin temperature model. (8 refs.)

119933 Magnetic susceptibility and ^{19}F nuclear magnetic resonance in nickel trifluoride. A.M.Panich, V.N.Ikorskii, A.A.Artyukhov (Inst. of Inorganic Chem., Acad. of Sci., Novosibirsk, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.518-19 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR),* vol.25, no.3, p.901-3 (March 1983). [received: Oct. 1983]
The authors have used the method of static magnetic susceptibility and of the NMR spectrum of ^{19}F to study the behavior of NiF_3, which is a new member of the group of compounds with the formula MF_3 and with formally the d^7 configuration of the paramagnetic nickel ion; they explain why this compound does not exhibit magnetic ordering right down to temperatures of about 1K. (12 refs.)

Molecular geometry of cis- and trans-polyacetylene by nutation NMR spectroscopy .... See Entry 118916

Anionic polymerization of isoprene by the complexes oligoisoprenyllithium/tertiary polyamines in cyclohexane. III. Structural study of the polymers by ^1H NMR at 100 MHz .... See Entry 118918

NMR studies of molecular motion and spin dynamics in TEA(TCNQ)$_2$ .... See Entry 118925

Effects of inhomogeneities in polyacrylamide gels on thermodynamic and transport properties .... See Entry 119228

Diffusion mobility of anions in fluorides of the elpasolite structure .... See Entry 119258

^{87}Rb electric field gradient tensors and the symmetry of the incommensurate phase in Rb_2ZnBr_4 and Rb_2ZnCl_4 .... See Entry 119531

Investigation on the physical properties of polypyrrole .... See Entry 119608

Influence of uniaxial pressure on the Neel temperature of antiferromagnet $CuCl_2.2H_2O$ .... See Entry 119846

Cis-trans isomerization of polyacetylene .... See Entry 120611

76.60C Chemical and Knight shifts

Structural analysis of 3-*C*-phosphonates, -phosphinates, and -phosphine oxides of branched-chain sugars .... See Entry 118990

Strong electron-phonon interaction in quasi-one-dimensional conductor $M_xV_2O_5$ systems .... See Entry 119589

76.60E Relaxation effects

119934 Dispersion of proton spin-lattice relaxation in a cholesteric liquid crystal. M.Vilfan, R.Blinc, J.Dolinsek, M.Ipavec, G.Lahajnar, S.Zumer (J. Stefan Inst., E. Kardelj Univ. of Ljubljana, Ljubljana, Yugoslavia).
J. Phys. (France), vol.44, no.10, p.1179-84 (Oct. 1983).
The frequency and temperature dependence of T_1 and T_{1p} in the cholesteric and isotropic phases of cholesteryl-oleyl-carbonate (COC) have been determined together with the temperature dependence of the self-diffusion constant D in the isotropic phase. In the MHz region the relaxation is dominated by molecular self-diffusion-with D being of the order 10^{-12} m^2/s—and by local molecular rotations with $\tau_c \approx 2\times10^{-10}$ s at $T=24°C$. In the kHz region, on the other hand, order director fluctuations predominantly influence the relaxation. The influence upon T_{1p} of the rotation of the molecules caused by their diffusion along the helix, an effect occurring only for twisted structures, was not observed in COC in view of too long a rotational correlation time. (20 refs.)

119935 Frequency and temperature dependence of ^1H NMR of trans-(CH)$_x$. P.E.Sokol (Ohio State Univ., Columbus, OH, USA), J.R.Gaines, S.I.Cho, D.B.Tanner, H.W.Gibson, A.J.Epstein.
J. Phys. Colloq. (France), vol.44, no.C-3, p.349-52 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors have carried out a study of the temperature ($0.3K<T<4.2K$) and frequency ($23\ MHz<f<35\ MHz$) dependence of the proton spin lattice relaxation time, T_1, of trans-$(CH)_x$. The data at 4.2K are in agreement with earlier measurements of Nechtschein et al. (1980). As the sample is cooled, T_1 continues to increase, with $T_1{}^{-1}=\alpha f^{-1}/_2-\beta$, where α and β are temperature dependent quantities. Alternately T_1 is expressed as an activated quantity, $T_1=A\ \exp(-\Delta/T)$, with $\Delta=\gamma H$ (A and γ constant). The observed g-factor of 3.3 for the activation energy suggests that the authors are in the low temperature limit for 1-D nuclear spin diffusion as discussed by Clark et al. (9 refs.)

119936 Temperature dependence of NMR T_1 and χ in Br_3, AsF_6-doped (CH)$_x$. K.Kume (Dept. Phys., Tokyo Metropolitan Univ., Tokyo, Japan), K.Mizuno, K.Mizogauchi, K.Nomura, H.Takayama, S.Ishibara, J.Tanaka, M.Tanaka, H.Fujimoto, H.Shirakawa.
J. Phys. Colloq. (France), vol.44, no.C-3, p.353-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors have measured the temperature dependence of proton NMR T_1 and Pauli paramagnetic susceptibility χ_p in Br_3- and AsF_6-doped $(CH)_x$. The microscopic conductivity σ_{NMR} has been calculated from them, and compared with σ_{DC}. (13 refs.)

119937 NMR investigations of native and doped polyacetylene films. M.Ziliox, B.Francois, C.Mathis, B.Meurer, P.Spegt, G.Weill (Centre de Recherches sur les Macromolecules, Strasbourg, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.361-4 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The results concern the second moment of the proton NMR line and the relaxation time T_1 of protonated, deuterated and ^{13}C enriched polyacetylenes. For the protonated cis and trans samples, progressively doped with iodine or sodium, the changes in the second moment reveal doping induced isomerization and further swelling of the lattice; the T_1 measurements are consistent with a decrease in number and mobility of neutral solitons upon doping. Preliminary results on deuterated and ^{13}C enriched samples show that, whereas proton magnetization recovers in an exponential way, ^2H and ^{13}C relaxations are well fitted by a double exponential function with time constants 1.5 and 8.6 s for the deuterated samples and 0.3 and 1.5 s for ^{13}C nuclei. (5 refs.)

119938 Nuclear magnetic relaxation in polyacetylene. J.C.Scott, T.C.Clarke (IBM Res. Lab., San Jose, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.365-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Nuclear spin-lattice relaxation rates for ^1H and ^{13}C in polyacetylene cannot be adequately explained in terms of either nuclear spin diffusion to a static paramagnetic defect or rapid one-dimensional diffusion of the defect itself. The authors propose a model in which a small fraction of the molecular chains contain defects. Nuclei on these chains are rapidly relaxed, while the remainder achieve equilibrium by nuclear spin diffusion. The dependences of the measured relaxation rates upon frequency and isotropic concentration are in agreement with the predictions of this model. (15 refs.)

119939 Dimensionality in (TMTSF)$_2$PF$_6$. L.J.Azevedo (Sandia Nat. Labs., Albuquerque, NM, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.813-18 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The dimensionality of the spin dynamics in $(TMTSF)_2PF_6$ has been studied in the high pressure metallic phase at low temperature via the field dependence of the nuclear spin-lattice relaxation rate ($T_1{}^{-1}$) of nuclear spins hyperfine coupled to the electron spin. Measurements of the relaxation rate of ^1H, ^{13}C and ^{77}Se over the field range 1-120 kOe establish two regimes. In the high field regime $T_1{}^{-1}$ varies logarithmically with magnetic field indicative of nuclear relaxation to a spin diffusing in two dimensions. Below 12 kOe $T_1{}^{-1}$ is independent of field indicating a crossover to three-dimensional motion. These results conclusively show that in the high pressure metallic phase $(TMTSF)_2PF_6$ is not a quasione-dimensional metal. (11 refs.)

119940 ^1H NMR relaxation studies of the organic conductor series (TMTTF)$_2$X; X=BF$_4$, PF$_6$, SCN. B.Liautard, S.Peytavin, G.Brun (Lab. de Chimie des Materiaux, Univ. des Sci. et Tech. du Languedoc, Montpellier, France), P.Bernier.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1087-9 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Using standard pulsed NMR at 26 MHz, the authors have studied the temperature dependence ($3.6<T<400K$) of the ^1H nuclear relaxation times T_1 and T_2 of the $(TMTTF)_2X$ systems when $X=BF_4$, PF_6 or SCN. The observed behaviours show typical features of relaxation induced by a coupling with the molecular motion of CH_3 groups on the TMTTF molecules. The occurrence, in some cases, of an electronic antiferromagnetic ordering at low temperature is discussed. (7 refs.)

119941 ^1H-NMR relaxation studies on the nature of the semiconducting state of (TMTTF)$_2$Br and (TMTTF)$_2$PF6: magnetism. T.Takahashi, F.Creuzet, D.Jerome (Lab. de Phys. des Solides, Univ. de Paris-Sud, Orsay, France), J.M.Fabre.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1095-7 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The electronic properties of $(TMTTF)_2Br$ and $(TMTTF)_2PF6$ have been studied by ^1H-NMR relaxation measurements. The low temperature semiconducting state in $(TMTTF)_2Br$ is shown to be a SDW state at ambient pressure and at 13 kbar, by the anomalies in T_1, T_2, and $T_2{}^*$. A phase transition is also observed in $(TMTTF)_2PF6$ but the magnetic nature is not so pronounced. It seems likely that the spin and lattice modulations coexist in the low temperature phase of $(TMTTF)_2PF6$. The authors discuss the possible crossover in the low temperature state in $(TMTTF)_2X$ family. (7 refs.)

119942 Crossover from localized to mobile electrons in Qn (TCNQ)$_2$. W.G.Clark, K.Glover, M.D.Lan (Phys. Dept., Univ. of California, Los Angeles, CA, USA), L.J.Azevedo.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1493-9 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Nuclear spin-lattice relaxation measurements are reported for $Qn(TCNQ)_2$ over the magnetic field range 10 Oe to 120 kOe at temperatures between 4.2K and 100K. They indicate that a crossover from localized to mobile 1-d electrons occurs near 20K. The distance an electron diffuses before confinement by a barrier or jumping to another chain varies from 30 Å at 19K to 155 Å at 100K. The observed behavior is consistent with diffusion among random barriers. (20 refs.)

119943 Two dimensional NMR time evolution correlation spectroscopy in liquid crystals. R.K.Shenoy, C.E.Tarr (Dept. of Phys. & Astron., Univ. of Maine, Orono, ME, USA), T.B.Tripp.
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.131-7 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Two dimensional NMR time evolution correlation spectroscopy, where a correlation of NMR relaxation and line-shapes are performed, provides a powerful tool in characterization of systems involving two or more spin groups. This technique is applied to proton NMR study in liquid crystal para-azoxy anisole in the nematic phase at two different frequencies. Two different spin groups corresponding to methyl and phenyl protons are identified, as expected. The methyl proton spin lattice relaxation time shows a greater frequency dependence compared to phenyl protons. (6 refs.)

119944 Proton dipolar spin-lattice relaxation in the smectic phases of TBBA. R.Y.Dong (Dept. of Phys. & Astron., Brandon Univ., Brandon, Manitoba, Canada), J.S.Lewis, E.Tomchuk, J.J.Visintainer, E.Bock.
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.139-47 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The proton dipolar spin-lattice relaxation time T_{1D} was measured at several Larmor frequencies in the various smectic phases of the liquid crystal terephthal-bis-butylaniline (TBBA) as a function of temperature and orientation of the sample in an external magnetic field. The angular dependent T_{1D} measurements are used to determine the importance of orientational order director fluctuations (ODF) in the dipolar field of the smectic phases of TBBA. In particular, the $T_{1D}{}^{-1}$ angular dependence in the S_A phase is different from that in the S_C and S_G phases. This contrasts sharply with the $T_1{}^{-1}$ angular dependence in these phases which are all similar. (13 refs.)

119945 Effect of tunnelling on the evolution of nuclear magnetisation. J.Peternelj, M.M.Pintar (Dept. of Phys., Univ. of Waterloo, Waterloo, Ontario, Canada).
Phys. Rev. B (USA), vol.28, no.5, p.2411-29 (1 Sept. 1983).
The semiclassical perturbation calculation of the nuclear-spin relaxation has been extended to lower temperatures by taking into account the tunnelling splittings of the lowest-energy states of NH_4 tetrahedron embedded in a crystal lattice. The effect of the lattice is represented by classical correlation functions. The proton-spin relaxation has been calculated for large and arbitrary tunnelling splittings in a tetrahedral crystal field, for the case of tunnelling around a single C_3 axis and around C_2 axes only. The cases of large tunnelling splitting in an asymmetric crystal field and in a crystal field with trigonal distortion are also discussed. The effect of tunnelling in a tetrahedral crystal field with a small distortion is examined in detail. It is shown that in a special case the tunnelling-assisted relaxation may be responsible for the establishment of equilibrium in a spin-polarisation-torsional spectroscopy experiment. The presented model calculation is valid at temperatures from ~100 to ~10K, when the correlation-function approximation breaks down. (17 refs.)

119946 NMR measurement of entanglement density in irradiated polyisobutylene. A.Charlesby, B.J.Bridges (Royal Military Coll. of Sci., Swindon, England).
Radiat. Phys. & Chem. (GB), vol.19, no.2, p.155-64 (1982). [received: Oct. 1983]
High molecule weight polyisobutylene shows a T_{2S} relaxation spectrum typical of a highly crosslinked or entangled network. In conformity with theory the reduction of molecular weight by radiation shows a reduction in the T_{2S} (network) fraction $(1-f)$, and an increase in the T_{2L}, (nonnetwork) fraction (f), until the network fraction disappears. The average molecular weight M_e between entangled units at 144°C is 2×10^4; it varies only slightly with temperature, and not significantly with overall molecular weight. The quantity $T_{2L}M_n{}^{-0.5}$ is constant at a fixed temperature T. Its variation with T is similar to that of viscosity. The variation of T_{2L} with molecular weight of molecules in the nonnetwork fraction and of T_{2S} with M_e in the network fraction do not agree with the theory for the two fractions considered separately. This is ascribable in part to their mutual interaction. (9 refs.)

119947 ^{19}F nuclear relaxation study of the fluorite systems: $K_{0.36}Bi_{0.64}F_{2.28}$. J.P.Donoso, H.Panepucci (Dept. de Fisica e Ciencia dos Materiais, Univ. de Sao Paulo, Sao Carlos, Sao Paulo, Brazil), A.Cassanho, H.Guggenheim.
Solid State Commun. (USA), vol.48, no.2, p.95-7 (Oct. 1983).
Measurements of the ^{19}F nuclear relaxation times T_1 and T_2 are reported for the fluorite-structured: $K_{0.36}Bi_{0.64}F_{2.28}$ single crystal, as a function of temperature and frequency. The main features of the experimental results are as follows: (a) the presence of a broad minimum and a highly assymetric shape in the T_1 vs. T^{-1} curve; (b) a strong dependence of T_1 with the nuclear Larmor frequency at low temperatures; and (c) the presence of a minimum of T_2 in the high temperature region. The NMR relaxation data is found to reflect the presence of a distribution of barrier energies for ionic motion characteristic of an inhomogeneous diffusion process. (12 refs.)

Evidence for inhomogeneities in polyethylene melts as detected by n.m.r. transverse relaxation and free induction .... See Entry 118846

On cooperative modes of reorientation in liquid crystals .... See Entry 118865

Existence of a novel liquid phase in methyl acetate .... See Entry 119169

Some properties of $(TMTSF)_2FSO_3$ at low temperature under pressure .... See Entry 119564

A magnetic state in the organic superconductor $(TMTSF)_2ClO_4$: cooling rate and strong magnetic field effects .... See Entry 119765

Spin dynamics and soliton motion in trans-$(CH)_x$ .... See Entry 119893

Electron spin motion in trans-$(CH)_x$ .... See Entry 119895

76.60G Quadrupole resonance

119948 Central transition NMR excitation spectra of half-integer quadrupole nuclei. A.Samoson, E.Lippmaa (Inst. of Chem. Phys. & Biophys., Acad. of Sci., Tallinn, USSR).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.205-8 (9 Sept. 1983).
A two-dimensional NMR technique for the study of half-integer quadrupole nuclei in powder samples is presented. Central transition excitation spectra provide a useful means for selective determination of the quadrupole interaction parameters in correlation with these of other interactions present. (13 refs.)

119949 First-principles theory of antishielding effects in the nuclear quadrupole interaction in ionic crystals: application to ^{57m}Fe in Fe_2O_3. A.C.Beri, T.Lee, T.P.Das (Dept. of Phys., State Univ. of New York, Albany, NY, USA), R.M.Sternheimer.
Phys. Rev. B (USA), vol.28, no.5, p.2335-51 (1 Sept. 1983).
A first-principles procedure is developed for the quantitative study of the widely differing Sternheimer antishielding effects that can be ascribed to the induced electric field gradients due to the various sources of electric field gradient in ionic crystals. The method involves the perturbation of the electronic states in the crystal by the nuclear quadropole moment of the central ion, and the use of these perturbed functions in an evaluation of components of the energy of the crystal which are linear in the quadropole moment. The authors have applied this ab initio method to a study of the nuclear quadrupole interaction for ^{57}Fe in Fe_2O_3 using a model in which an Fe^{3+} ion is surrounded by six O^{2-} ligands whose charge distributions overlap the Fe^{3+} ion. The application of their procedure to the model of overlapping ions leads to the important conclusion that the field gradients due to the various sources in the central cluster and the surrounding lattice are all subject to very different antishielding effects. The sources involved can be grouped broadly into three classes: local, nonlocal, and distant, with the local sources involving charge densities purely central in character, nonlocal sources involving charge densities composed of one central-ion orbital and one ligand-ion orbital, and the distant sources involving two categories, a distant electronic one composed of charge densities from purely ligand-ion orbitals, and a distant nuclear one, comprising the nuclear charges on the ligand ions (O^{2-}). The effective antishielding factors γ_{eff} associated with these sources were found to be, respectively, -0.2, -0.7, -3.8, and -6.5, all very different from $\gamma_\infty=-9.19$ for the Fe^{3+} ion appropriate a totally external point-charge source and $R=+0.07$, the shielding factor with the field gradient due to the $3d$ valence shell in the Fe^{2+} ion, which have both been used in the past as approximate choices for the various γ_{eff}. The substantial differences between the various effective antishielding factors γ_{eff} found in the present work are explained physically by the consideration of the different degrees of penetration of the charge densities corresponding to the various sources producing the field gradients into the region of the Fe^{3+} ion. (80 refs.)

Structural phase transition of $CsPbCl_3$ below room temperature .... See Entry 119179

76.70 MAGNETIC DOUBLE RESONANCES AND CROSS EFFECTS

76.70D Electron-nuclear double resonance (ENDOR)

119950 Magnetic properties. II. ENDOR of undoped cis-$(CH)_x$. L.R.Dalton, H.Thomann, H.Kim (Dept. of Chem., Univ. of Southern California, Los Angeles, CA, USA), Y.Tomkiewicz, N.S.Shiren, T.C.Clarke.
J. Phys. Colloq. (France), vol.44, no.C-3, p.229-32 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
For pt.I see ibid., vol.44, no.6, p.C3/223. Pristine 99% ^{13}C-enriched cis-polyacetylene has been investigated by electron-nuclear double-resonance (ENDOR) spectroscopy at temperatures between 77 and 300K. Spectra are characterized by two and only two ^{1}H and ^{13}C hyperfine tensors. The relative magnitudes and symmetry of the tensor elements establish that the paramagnetic electron resides in a delocalized orbital. Experimental results indicate that the delocalized electron is constrained to a potential well of approximately 100 Å in width. (4 refs.)

119951 Magnetic properties of polyacetylene composites [ENDOR and electron spin echo studies]. H.Thomann (Dept. of Chem., Univ. of Southern California, Los Angeles, CA, USA), L.R.Dalton, M.E.Galvin, G.E.Wnek, Y.Tomkiewicz.
J. Phys. Colloq. (France), vol.44, no.C-3, p.313-16 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Composites of low density polyethylene, LDPE, and trans-Polyacetylene, t-$(CH)_x$, prepared by polymerization of acetylene in LDPE films impregnated with a Ziegler-Natta catalyst, have been studied by Electron Nuclear Double Resonance (ENDOR) and Electron Spin Echo (ESE) spectroscopies and the results compared with analogous studies conducted on trans-polyacetylene films. ENDOR measurements indicate that the wavefunction, a highly delocalized pure π-orbital, is essentially the same in composites as in pure polyacetylenes but at a given temperature the electron spin diffusion coefficient is substantially reduced. ESE phase memory times, T_M, measured by a 90°-180° pulse technique exhibited the same general function dependence on temperature; however, T_M times (hence electron spin diffusion correlation times) for the composites were substantially longer at each temperature. These results imply a reduced spin diffusion coefficient and increased activation energy in the composites compared to pure polyacetylene. Phase memory times for the composites appear less sensitive to prolonged exposure to oxygen than is the case for pure polyacetylene; however, prolonged exposure does shorten phase memory times and reduce the 'effective' activation energy for the dynamic process or processes which determines phase relaxation by modulation of the magnetic interactions. (5 refs.)

119952 Two types of F centres in alkaline earth fluoro-halides. II. Double ENDOR experiments. J.R.Niklas, R.U.Bauer, J.-M.Spaeth (Fachbereich Phys., Univ.-GH Paderborn, Paderborn, Germany).
Phys. Status Solidi b (Germany), vol.119, no.1, p.171-8 (1 Sept. 1983).
For pt.I see ibid., vol.118, p.557 (1983). In crystals containing simultaneously $F(Cl^-)$ and $F(F^-)$ centres in certain frequency regions the ENDOR spectra are superimposed to such a degree that an analysis is not possible. With double ENDOR experiments the ENDOR spectra of both centres can be separated. The ratio of the ENDOR signal heights compared to the double ENDOR signal heights is found to be characteristic for the shell of the nuclei involved. It can be used to discriminate between ENDOR lines of different shells. The effect cannot be understood on the basis of rate equations with reasonable assumptions for the spin-lattice relaxation times. It is probably due to spin diffusion. (13 refs.)

119953 Nonlinear effects in the electron-nuclear spin system of a semiconductor following absorption of light of variable circular polarization. R.I.Dzhioev, I.A.Merkulov, M.N.Tkachuk, V.G.Fleisher (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.6, p.1304-8 (Dec. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.6, p.2252-9 (Dec. 1982). [received: Oct. 1983]
Investigates theoretically and experimentally nonlinear phenomena that accompany orientation of the electron-nuclear spin system of a semiconductor

by light whose circular polarization oscillates in time at high frequency. The authors show that resonant absorption of the nuclear spin system in a field oscillating at close to the NMR frequency and produced by the oriented electrons at the nuclei can lead on the onset of bistable states of the electronic polarization. These states are connected with the partial cancellation of the external constant magnetic field by the effective nuclear field produced at the electrons by the polarized nuclei. The authors show in addition that a strong nuclear field can appear under nonresonant conditions if besides the modulation of the polarization of the exciting light one applies to the sample an external magnetic field that oscillates in phase with the average spin of the produced electrons. The appearance of this field is the cause of the instability of the electron-nuclear spin system in a zero constant magnetic field. (12 refs.)

A theoretical analysis of electron Zeeman and hyperfine tensors for polyacetylene ....See Entry 119529

Structure and kinetics of some paramagnetic oxygen centres in synthetic calcium fluoride crystals ....See Entry 119914

76.70E Dynamical nuclear polarization

Spin dynamics and soliton motion in trans-$(CH)_x$ ....See Entry 119893

76.70H Optical double magnetic resonance (ODMR)

Luminescence and magnetic resonance in post-hydrogenated microcrystalline silicon ....See Entry 120147

76.80 MÖSSBAUER EFFECT; OTHER GAMMA-RAY SPECTROSCOPY

119954 Formation of the crystal structure of the ferrite $BaFe_{12}O_{19}$. L.M.Letyuk, M.N.Shipko, V.S.Tikhonov, M.V.Dmitriev (Moscow Inst. of Steel & Alloys, Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.10, p.1505-8 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1751-4 (Oct. 1982). [received: Sept. 1983]
The processes occurring during the formation of the crystal structure of the hexagonal ferrite $BaFe_{12}O_{19}$ have been studied by Mossbauer spectroscopy. It has been established that at 1000-1100K the lattice of the ferrite $BaFe_{12}O_{19}$ forms by means of the diffusion of Ba^{2+} and O^{2-} ions into α-Fe_2O_3 without the appearance of intermediate phases. It has been shown that at 1300-1500K the formation of this ferrite is also limited by diffusion processes. However, the formation of the ferrite $BaFe_{12}O_{19}$ through intermediate phases of $BaFe_2O_{14}$ or Fe_3O_4 is possible. (6 refs.)

119955 Isomer shifts and force constants of substitutional ^{119}Sn impurity atoms in FCC metals. H.Andreasen, S.Damgaard, J.W.Petersen, G.Weyer (Inst. of Phys., Univ. of Aarhus, Aarhus, Denmark).
J. Phys. F (GB), vol.13, no.10, p.2077-88 (Oct. 1983).
Isomer shifts and Debye temperatures for substitutional ^{119}Sn impurity atoms in the FCC metals Al, Ag, Au, Cu, Pb, Pd, Pt and Rb were determined by Mossbauer emission spectroscopy on the 24 keV γ radiation of ^{119}Sn. The radiation sources were prepared by ion implantations of radioactive ^{119}In and ^{119}Sb isotopes into single crystals and high-purity foils of the respective metals. Correlations are discussed between measured isomer shifts and electronic properties of the host materials (the Fermi-level free-electron density $n_F^{1/3}$ and the cell-boundary electron-density parameter $n_{WS}^{1/3}$ from the Miedema theory of alloy formation). The Debye temperatures for ^{119}Sn are interpreted in terms of the Einstein-Debye and the Mannheim models for impurity lattice vibrations. (39 refs.)

119956 Magnetism in Eu-based amorphous alloys from local and bulk investigations. M.Maurer, J.M.Friedt (CRN, Strasbourg, France).
J. Phys. F (GB), vol.13, no.10, p.2175-88 (Oct. 1983).
The magnetic properties of Eu^{2+} ($4f^7$ electronic configuration) based amorphous alloys $Eu_{1-x}X_x$, where X=Mg, Zn, Cd and Al and $x \simeq 0.3$, have been investigated by studying local moments from ^{151}Eu Mossbauer spectroscopy and bulk magnetisation in low AC and high DC fields. The divalent $4f^7$ state of Eu atoms implies vanishing interactions with crystal fields. The magnetic properties are then assumed to be depicted by localised $4f^7$ moments interacting via RKKY interactions, in view of the pure s (Mg, Zn, Cd) or sp (Al) character of the valence electron shells of the components. Amorphous $Eu_{1-x}Al_x$ (x=0.225, 0.30 and 0.40) are concentrated spin glasses (mictomagnets). Amorphous $Eu_{0.70}Zn_{0.30}$ (T_C=133K) and $Eu_{0.75}Cd_{0.25}$ (T_C=134K) reveal all the properties of soft ferromagnets in the presence of some distribution of the exchange interaction, resulting from the disorder. Amorphous $Eu_{0.70}Mg_{0.30}$ exhibits a double magnetic transition, i.e. from paramagnetic to ferromagnetic, at T_C=131K and from ferromagnetic to spin glass at $T_{SG} \simeq 52$K. The latter re-entrant spin-glass transition is consistently characterised both from AC susceptibility and from the anomalous temperature dependence of the hyperfine field distribution. Amorphous $Eu_{0.70}Mg_{0.30}$ is concluded as representing an example of a cluster spin glass (with intercluster frustration) whereas the amorphous $Eu_{1-x}Al_x$ alloys would present short-range frustration. (29 refs.)

119957 Mossbauer study of SbF_5-doped polyacetylene. F.Godler, B.Perscheid, G.Kaindl (Freie Univ. Berlin, Berlin, Germany), K.Menke, S.Roth.
J. Phys. Colloq. (France), vol.44, no.C-3, p.233-7 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
SbF_5-doped polyacetylene was studied on samples with dopant concentrations ranging from 0.1 to 8.4 mol%, using ^{121}Sb Mossbauer spectroscopy. The spectra reveal the presence of SbF_3, SbF_5, and SbF_6^-, respectively. From the relative intensities of the well-separated subspectra the authors could determine the relative fractions of the three molecular species as a function of dopant concentration. (5 refs.)

119958 Mossbauer spectroscopy studies of polyacetylene doped chemically and electrochemically with iron chlorides. Z.Kucharski (Inst. of Nuclear Res., Otwock-Swierk, Poland), M.Lukasiak, J.Suwalski, A.Pron.
J. Phys. Colloq. (France), vol.44, no.C-3, p.321-4 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Doping of polyacetylene with iron chloride complexes has been studied by Mossbauer spectroscopy. It was proved that the doped polymer undergoes degradation in air manifested by the formation of $FeCl_2.nH_2O$ with the simultaneous chlorination of the double bond. (6 refs.)

119959 Temperature depedence of the electric field gradient in $AgIn_2$ intermetallic compound. L.G.Brunnet, M.Behar, R.Iglesias, J.A.H.Da Jornada, R.P.Livi (Inst. de Fisica, Univ. Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil), H.Saitovitch.
Phys. Lett. A (Netherlands), vol.97A, no.7, p.294-6 (12 Sept. 1983).
The temperature dependence of the electric field gradient in the $AgIn_2$ intermetallic compound was measured using the TDPAC technique. From 80K up to 415K a linear dependence was found. Below 80K a change in this behaviour was observed. This and previous results are interpreted as related to optical-phonon modes in intermetallic compounds. (8 refs.)

119960 Nuclear level mixing resonances on low temperature oriented nuclei. R.Coussement, P.Put, L.Hermans, M.Rots (Inst. voor Kern- en Stralingsfysika, Leuven Univ., Leuven, Belgium).
Phys. Lett. A (Netherlands), vol.97A, no.7, p.301-4 (12 Sept. 1983).
The angular distribution of gamma radiation emitted from oriented nuclei can show resonance signals under the influence of combined magnetic and electric quadrupole interactions acting as an intermediate state perturbation. An exploratory experiment shows the feasibility of this method. Perspectives of using these level mixing resonances on oriented nuclei (LMR/ON) are also discussed. (6 refs.)

119961 Mossbauer study of the lattice location of ^{57}Co implanted in graphite. M.De Potter, G.Langouche (Inst. voor Kern- and Stralingsfysika, Leuven Univ., Leuven, Belgium).
Phys. Lett. A (Netherlands), vol.97A, no.9, p.404-8 (26 Sept. 1983).
The lattice location of ^{57}Co implanted into graphite is studied by ^{57}Fe Mossbauer spectroscopy. An asymmetric doublet is observed. From a study of the line intensities as a function of crystallographic orientation, sample temperature and annealing treatment, it is concluded that this is not a quadrupole doublet, but belongs to two different Co configurations in graphite. (17 refs.)

119962 Iron hyperfine field distribution in amorphous Fe-Ni-Cr-Mo-Si-B. G.Rajaram (Tata Inst. of Fundamental Res., Bombay, India), S.Prasad, G.Chandra, S.N.Shringi, R.Krishnan.
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.57-9 (3 Oct. 1983).
The distribution of Fe hyperfine fields, $P(H)$, has been studied for the amorphous ferromagnetic alloys $Fe_{40-x/2}$ $Ni_{40-x/2}Cr_xMo_2Si_{10}B_8$, x=0, 1, 3, 4, 5 by Mossbauer measurements at room temperature. The results favour a bimodal distribution for $P(H)$ as suggested earlier for METGLAS 2826A. The low field component is found to increase with x. (13 refs.)

119963 Atomic structure and magnetic properties of the pseudobinary alloys Fe_3(Al, Si). O.Schneeweiss, T.Zemcik, T.Zak (Inst. of Phys. Metall., Acad. of Sci., Brno, Czechoslovakia), S.Mager.
Phys. Status Solidi a (Germany), vol.79, no.1, p.125-9 (Sept. 1983).
The influence of substitution of Al by Si on the atomic order, saturation magnetic polarization, and electrical resistivity is studied in $Fe_3Al_{1-x}Si_x$, $0 \leq x \leq 1$, alloys. The changes in the hyperfine parameters of the ^{57}Fe Mossbauer spectra indicate that the degree of DO_3 order after order anneal is increased, accompanied by a separation of the Fe_3Si and Fe_3Al types of local surroundings. The most significant changes of isomer shifts, magnetic hyperfine fields, saturation magnetic polarization, and electrical resistivity due to atomic order are observed near the Fe_3Al and $Fe_3Al_{0.25}Si_{0.75}$ compositions. (10 refs.)

119964 Defect recovery and trapping in plastically deformed Au studied by perturbed angular correlations of ^{111}In. G.S.Collins, C.Allard, R.B.Schuhmann, C.Hohenemser (Dept. of Phys., Clark Univ., Worcester, MA, USA).
Phys. Rev. B (USA), vol.28, no.6, p.2940-6 (15 Sept. 1983).
Au samples doped with ^{111}In impurities and heavily deformed at 77K were studied by perturbed angular correlations after undergoing isochronal annealing up to 500K. Between 150 and 500K the authors detected formation and dissolution of five defect-probe traps characterized by distinctive quadrupole interaction frequencies. Based on previous identifications of four of the traps and arguments that a previously undetected trap forming at 162K has vacancy character, their experiments suggest trivacancy, divacancy, and monovacancy recoveries at 162, 180, and 240K, respectively. From the order of the recoveries, they conclude that all three species are present immediately after deformation. For divacancies they observed thermally activated in situ transformation between two distinguishable trap configurations. The details of their isochronal annealing curves are well simulated via a kinetic rate model which assumes only first-order processes, and the trapping stages are found to explain most but not all features of stored-energy-release measurements. (22 refs.)

119965 Investigation of magnetic properties of amorphous ferrite magnetic materials by the Mossbauer method. Yu.T.Pavlyukhin, Ya.Ya.Medikov, V.V.Boldyrev (Inst. of Solid-State Chem. & Processing of Minerals, Acad. of Sci., Novosibirsk, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.358-60 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.630-4 (March 1983). [received: Oct. 1983]
The Mossbauer spectroscopy method was used to investigate the magnetic properties and steric characteristics of exchange pairs in amorphous ferrite magnetic materials prepared by mechanical activation of polycrystalline zonc and nickel ferrites. It was found that the oxygen sublattice of such magnetic materials remained close-packed, but the sequence of the oxygen planes was disturbed. Cations were transferred from the tetrahedral to the octahedral positions, so that all the cations in these amorphous materials were solely in positions of octahedral environment of oxygen ions. The Neel temperature of zinc ferrite increased from 9 to ~210K, whereas that of nickel ferrite decreased from 858 to ~260K, compared with the crystalline analogs of these materials. (11 refs.)

119966 Isomeric and Knight shifts for a conductor with resonance states of electrons at defects. V.O.Sokolov.
Sov. Phys.-Solid State (USA), vol.25, no.3, p.513 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.892-4 (March 1983). [received: Oct. 1983]
The author studies the effect of defect resonance levels on the isomeric and Knight shifts of the spectra of the hyperfine interaction of nuclei with the conduction electrons. He denotes by $\Delta(T)$ the isomeric shift of a Mossbauer line at a temperature $T \ll \epsilon_F/k_B$ measured relative to the position of the line at the same temperature in a perfect crystal. (5 refs.)

Study of the system $NH_4Fe(SO_4)_2$-H_2SO_4-H_2O or 25°C and the appearance of solid phases ....See Entry 119204

Electric field gradients of Lu and Hf in Re ....See Entry 119532

Magnetic behavior of Dy^{3+} ion in $Dy_2(SeO_4)_3.8H_2O$. Experimental and theoretical study including the effects of *J-J* mixing ....See Entry 119809

Mossbauer-effect study of the Morin transition and atomic positions in hematite under pressure ....See Entry 119842

Mossbauer studies of the static and dynamic critical behavior of the layered antiferromagnets $RbFeF_4$ and $KFeF_4$ ....See Entry 119844

Magnetic and Mossbauer studies of some mixed cobaltites of the lanthanides and alkali metals .... See Entry 119872

Interface magnetism of Fe-Sb multilayered films with artificial superstructure from ^{57}Fe and ^{121}Sb Mossbauer spectroscopy, neutron diffraction and FMR experiments .... See Entry 119879

77.00 DIELECTRIC PROPERTIES AND MATERIALS

(for conductivity phenomena, see 72.20 and 72.80)

77.20 PERMITTIVITY

119967 Dielectric properties of fibre glass epoxy laminate in high frequency transitory regime. F.Vilches De Frutos, J.M.Guerra Perez (Facultad de Ciencias Fisicas, Univ. Complutense, Madrid, Spain).
An. Fis. Ser. B (Spain), vol.79, no.2, p.134-40 (May-Aug. 1983). In Spanish. [received: Oct. 1983]
The dielectric constant from fiber glass epoxy laminate used in pulsed transversaly excited lasers is measured in a high-frequency (0.5-100 MHz) high-voltage ($\simeq$10 KV) sinusoidal transitory regimen. The authors obtain an interval of constancy of the real part of the permittivity longer than when measured by classical methods. This enlargement appears on the section of the spectrum where the laser operates. (8 refs.)

119968 Dielectric study of S_{A1}, S_{A2} and $S_{\tilde{A}}$ phases in liquid crystals of cyano compounds. C.Druon, J.M.Wacrenier, F.Hardouin, Nguyen Huu Tinh, H.Gasparoux (Univ. de Lille, Villeneuve d'Ascq, France).
J. Phys. (France), vol.44, no.10, p.1195-200 (Oct. 1983).
The authors present a dielectric study of the monolayer (SA_1) and bilayer (SA_2) smectic phases and of the smectic antiphase ($S_{\tilde{A}}$) for a mixture of 4-cyanobenzoyloxy-4′-pentyl stilbene (C5 stilbene for short) and 4-*n*-hexylphenyl-4′-cyanobenzoyloxy benzoate (DB6 for short) and for the pure compound DB6. For the measurement with the direction of the electric field **E** parallel to the director **n**, in the S_{A2} phase, the dielectric spectra observed reveal: a decrease of $\epsilon'_{\parallel}$, an increase of the activation energy of the molecular reorientation mechanism for DB6, the appearance of a second absorption domain for the mixture, connected either to a cooperative phenomenon or to the existence of molecules of different types. For $\mathbf{E} \perp \mathbf{n}$, the study shows mainly an increase of $\epsilon'_{\perp}$ at the transitions N-$S_{\tilde{A}}$ and N-S_{A2}. These results suggest that there are strong correlations between the molecular motions, due to the presence of strong interactions, particularly in the S_{A2} phase. These correlations are probably due, for the compounds studied, to the existence in the molecule of groups with dipolar moments whose transverse components are important. (27 refs.)

119969 Semi-empirical expression for the dielectric constant of polar, polarisable liquids. J.R.Macdonald, S.W.Kenkel (Dept. of Phys. & Astron., Univ. of North Carolina, Chapel Hill, NC, USA).
J. Phys. D (GB), vol.16, no.10, p.L195-9 (14 Oct. 1983).
A new formula is compared with that of Onsager, Kirkwood and Frohlich (OKF) for 39 associated and non-associated liquids. The new expression is found to be generally superior to the older one and often yields excellent estimates of the static dielectric constant with no disposable parameters such as the uncertain Kirkwood correlation factor *g* needed in the OKF equation. (15 refs.)

119970 Dielectric properties of some insulating liquids. K.N.Abd-El-Nour, F.F.Hanna (Nat. Res. Centre, Cairo, Egypt).
J. Polym. Sci. Polym. Lett. Ed. (USA), vol.21, no.9, p.723-9 (Sept. 1983).
Mineral pertroleum oils are the most commonly used of all insulating liquids in transformers and capacitors. Vegetable oils are also used as insulating and cooling liquid in some types of transformers and as plasticizers in synthetic resin compositions. Systematic studies of the dielectric properties of these oils are not yet available over a wide range of frequency and temperature. The authors aim to cover this lack of information. (8 refs.)

119971 Low-temperature dielectric constant of near-stoichiometric Na β-alumina. J.N.Dobbs, A.C.Anderson (Dept. of Phys., Univ. of Illinois at Urbana-Champaign, Urbana, IL, USA), W.Hayes.
Phys. Rev. B (USA), vol.28, no.6, p.3559-60 (15 Sept. 1983).
Measurements of the dielectric constant of Na β-alumina at temperatures below 2K reveal that the density of low-energy excitations is not a function of the Na stoichiometric excess for the range 7-35% excess Na. (12 refs.)

Volumetric and dielectric properties of benzene solutions of some tri-n-alkylammonium halides at 298.15K .... See Entry 119082

Soft modes of crystals belonging to the SbSI-SbSBr system . See Entry 119146

Successive phase transitions in Cs_2CdBr .... See Entry 119174

Trends in optical parameters and band structure with increasing hydrogenation of amorphous silicon .... See Entry 119418

Electron localization near a band edge and dielectric constant of TCNQ salts with strong structural disorder .... See Entry 119500

DC and microwave conductivity of $FeCl_3$-doped polyparaphenylene $(p\text{-}C_6H_4)_x$ .... See Entry 119561

Comment on 'Dielectric relaxation of adsorbed water in microcrystalline cellulose' .... See Entry 119977

Dielectric, pyroelectric, and magnetic properties of $BiMn_2O_5$ crystals .... See Entry 119989

Ferroelectricity and dielectric critical slowing-down in $LiNaGe_4O_9$ single crystal .... See Entry 119990

Study of ferroelectric CsH_2PO_4 by the ultrasonic velocity and attenuation measurements .... See Entry 119993

Growth and investigation of $Ca_3(VO_4)_2$ .... See Entry 120237

77.30 POLARIZATION AND DEPOLARIZATION EFFECTS

119972 Effect of gas on the electret charge reduction by radiation. M.Ikeya (Tech. Coll., Yamaguchi Univ., Ube, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1200-5 (July 1983).
The radiation-induced reduction of the surface charge on polymer foil thermoelectrets has been studied in relation to the effect of the gas surrounding the electret. The reduction of the charge due to gas ion collection depends strongly on the gas in the chamber. The charge reduction in a parallel-plate electret dosimeter is treated theoretically following the ionization chamber theory for the electret-induced electric field strength of the ionization chamber region (ICR) and the gas ion recombination region (RR). The exponential reduction of the charge by radiation in an intense electret of fluoride polymers is also described, using the gas ion multiplication model. The electric field induced by the electret is considered to have entered the proportional counter region (PCR). (23 refs.)

119973 Thermally stimulated current of crosslinked polyethylene by electron beam irradiation. M.Hanai, M.Aihara, F.Aida, T.Shiono.
Showa Wire & Cable Rev. (Japan), vol.33, no.1, p.61-6 (1983). In Japanese.
The change in AC breakdown voltage in polyethylene insulation was investigated after crosslinking by electron beam irradiation. TSC (thermally stimulated current) of the irradiated polyethylene insulation was measured in order to estimate the distribution of space charges resulting from irradiation. As a result, it was found that when the maximum depth of the electron penetration was too low for the thickness of insulation, the insulation retained residual space charges, causing a reduction in AC breakdown voltage. It is conceivable that an electrostatic field induced by the residual charges is superimposed on the AC field, thus allowing an intense electric field to be formed in the insulation. The TSC peak from residual charges disappeared after heat treatment. Crystallinity of polyethylene correlates with the TSC peak area. Therefore, it may be postulated that charges are trapped in crystal boundaries. Electron beam curing process provides a highly practical technique for manufacturing crosslinked polyethylene insulated wires, but care should be taken in determining the manufacturing conditions and the insulating materials considering the effect of space charges. (11 refs.)

Ionic and electronic processes during Frenkel defect annealing in KBr crystals above LHeT .... See Entry 119012

Band structure, spontaneous polarization and index of refraction above and below the Curie point of $BaTiO_3$ and $KNbO_3$ .... See Entry 119435

Modeling of thermally stimulated currents in polytetrafluoroethylene .... See Entry 119983

Ferroelectricity and dielectric critical slowing-down in $LiNaGe_4O_9$ single crystal .... See Entry 119990

Crystalline ferroelectrics with glassy polarisation behaviour .. See Entry 120006

Investigation of laser-induced luminescence and polarisation change in ferroelectric $AgNa(NO_2)_2$ in the time domain .... See Entry 120133

77.40 DIELECTRIC LOSS AND RELAXATION

119974 Dielectric relaxation spectroscopy of sheet molding compound. K.Venkataswamy, K.E.Stephens, H.Hughes, C.L.Beatty (Dept. of Materials Sci. & Engng., Univ. of Florida, Gainesville, FL, USA).
Polym. Compos. (USA), vol.4, no.3, p.180-2 (July 1983).
Dielectric relaxation spectroscopic studies of sheet molding compound from 400 Hz to 100 kHz reveal the relaxation processes that exist in this material. The frequency dependence of SMC is presented and analyzed in terms of different relaxation process models. A transition map of SMC is presented. (12 refs.)

119975 Dielectric relaxation processes of some dialkyl disulfides. H.A.Khwaja, S.Walker (Dept. of Chem., Lakehead Univ., Thunder Bay, Ontario, Canada).
Can. J. Chem. (Canada), vol.61, no.9, p.2107-11 (Sept. 1983).
Dielectic relaxation studies have been performed for dimethyl, diethyl, diisopropyl, di-n-butyl, di-tert-butyl, and di-n-octyl disulfides in a polystyrene matrix. For the last five compounds the absorption appears in two temperature regions. The relaxation data for the higher temperature regions are consistent with intramolecular rotation around the S-S bond with accompanying flexibility in the alkyl chains. The enthalpy barrier to this relaxation process is $\sim$29 kJ mol^{-1} and is the trans (lower) barrier. This value is typical for all six dialkyl disulfides. The most likely interpretation of the low temperature process is that there is segmental relaxation of the alkyl chains which also involves movement of the main dipoles (S-S and S-c). (23 refs.)

119976 Primary amines: a low-temperature dielectric relaxation study. J.Gilchrist (Centre de Recherches sur les Tres Basses Temperatures, CNRS, Grenoble, France).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.63-72 (Oct. 1983).
The 4.2K dielectric absorption spectrum of a polyethylene film containing 1-aminoadamantane is reported. At very low frequencies the absorption varied as the square root of frequency, and the Cole-Cole plot approached the real axis at 45°. This exemplifies a characteristic behaviour of primary amines and is to be expected only if the amino proton spin symmetry species are relatively long lived. Tunnel splittings of the normal and deuterated species are evaluated. Eighteen other amine species were studied, including aminocycloalkanes, alkylhydrazines and dialkylhydrazines. Aminocyclobutane relaxed faster than most (low inversion barrier) and methylhydrazine relaxed slowly in accordance with expectations based on its microwave spectrum. (33 refs.)

119977 Comment on 'Dielectric relaxation of adsorbed water in microcrystalline cellulose'. R.P.Singh (Dept. of Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
J. Phys. D (GB), vol.16, no.10, p.L207-8 (14 Oct. 1983).
For original paper see ibid., vol.16, p.915 (1983). The accuracy of the measurement technique used by Kent and Meyer and the reliability of their data on dielectric constant ϵ' and loss tangent ϵ'' are discussed. (5 refs.)

119978 Fast response of a dielectric to the motion of a charge. H.L.Friedman (Chem. Dept., State Univ. of New York, Stony Brook, NY, USA).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1465-7 (Sept. 1983).
Within the continuum theory of dielectric response there is a common mechanism for the two relaxation times which may be elicited by appropriate experiments. An explanation of this paradox is offered. (10 refs.)

119979 Dielectric relaxation and order parameters in mixtures of 4-cyanobiphenyl and MBBA. V.K.Agarwal, A.H.Price (Edward Davies Chem. Lab., Univ. Coll. of Wales, Aberystwyth, Wales).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.193-200 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Dielectric studies on MBBA and its solutions doped with 4-cyanobiphenyl (CB) are reported at reduced temperatures of 0.996 over the frequency range of 0 to 200 MHz. The longitudinal and transverse dipole components are evaluated as well as the order parameter. The results are self consistent only after an additional relaxation process is presumed at frequencies greater than 200 MHz. This may arise from the internal rotation of the terminal methoxy group in MBBA. (7 refs.)

Molecular reorientation in liquid crystals ....See Entry 118871

Study of S_A phase structure using dielectric relaxation ....See Entry 118874

Dielectric, pyroelectric, and magnetic properties of $BiMn_2O_5$ crystals ....See Entry 119989

77.50 DIELECTRIC BREAKDOWN AND SPACE-CHARGE EFFECTS

119980 Effect of prestressing on electrical breakdown in polyethylene at high temperature. S.Katakai, K.Yahagi (Dept. of Electrical Engng., Waseda Univ., Tokyo, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1221 (July 1983).
High-temperature breakdown in polyethylene with fixed electrodes is reported. The samples consisted of low-density polyethylene (LDPE) film (melt index $M.I=3.0$, density $\rho=0.917$ g/cm^3, thickness $d=50$ μm) embedded in a cured epoxy resin with stainless-steel ball electrodes. Following a period of prestressing with negative direct voltage, a positive or negative impulse voltage was superimposed on the direct voltage. Two cases occurred: (i) when the impulse voltage produced a reversal of polarity on the sample, and (ii) when the polarity remained unchanged. (2 refs.)

119981 Influence of molecular structure on the low frequency dielectric relaxation of *p*-cyano-substituted liquid crystals in nematic solution. G.Heppke, J.Kayed, U.Muller (Liquid Crystal Res. Group, Tech. Univ. Berlin, Berlin, Germany).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.309-19 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The dielectric properties of several *p*-alkyl-*p*′-cyano-substituted liquid crystals of different molecular length, dissolved in the nematic mixture ZLI 1275, have been investigated as a function of frequency and temperature. Low relaxation frequencies have been observed which decrease from 138 kHz to 1.5 kHz at 25°C roughly corresponding to the increase of molecular length. Arrhenius plots show good linear relations with the activation energies being found to increase with decreasing relaxation frequency. (14 refs.)

119982 Firing wave instability of the current filaments in a semiconductor. An analogy with neurodynamics. K.Aoki, K.Yamamoto (Dept. of Electrical & Electronic Engng., Kobe Univ., Kobe, Japan).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.72-6 (3 Oct. 1983).
Periodic oscillations and chaos have been observed in the firing density wave of the current filaments in n-GaAs at 4.2K. The mechanism of the firing-wave instability has been discussed by an analogy with neurodynamics. (14 refs.)

Thermally stimulated current of crosslinked polyethylene by electron beam irradiation ....See Entry 119973

77.55 DIELECTRIC THIN FILMS

119983 Modeling of thermally stimulated currents in polytetrafluoroethylene. R.L.Remke (Bell Labs., Indianapolis, IN, USA), H.von Seggern.
J. Appl. Phys. (USA), vol.54, no.9, p.5262-6 (Sept. 1983).
A phenomenological model has been derived for the thermally stimulated open-circuit current measured on negatively charged polytetrafluoroethylene electret film. The model is based on trap controlled release of negative charge carriers using approximations justified by thermally stimulated current and mean charge depth results. To describe the open-circuit current, a minimum of five traps was necessary including surface and bulk traps with activation energies of 1.3(2), 1.4, 1.5 and 1.7 eV. In addition, attempt-to-escape frequencies were calculated and found in the range 10^{11}-10^{13} s^{-1}. (36 refs.)

Effect of prestressing on electrical breakdown in polyethylene at high temperature ....See Entry 119980

77.60 PIEZOELECTRICITY AND ELECTROSTRICTION

(for piezo-optical effects, see 78.20H)

119984 Echo phenomena in piezoelectric powders. I.Turek, I.L.Bajak (Dept. of Phys., Tech. Univ. of Transport & Telecommunications, Zilina, Czechoslovakia).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.5-6, p.293-305 (1983).
The problem under discussion is the dynamical and the memory echo formation in piezoelectric powders. It enables the authors to classify different mechanisms of echo creation. The mechanism of permanent echo as well as the mechanism of the formation of memory due to Chladni's effect are suggested as new, so far unknown processes of echo creation. (11 refs.)

119985 Influence of additions on the electrophysical properties of lead titanite zirconate. O.S.Didkovskaya, V.A.Zvonik, G.E.Savenkova, N.I.Selikova, V.S.Lyushenko, V.V.Dorofeeva, V.V.Klimov (All-Union Sci.-Res. Inst. of Reagents & Chemically Pure Materials for Electronics, SSR).
Inorg. Mater. (USA), vol.18, no.10, p.1502-5 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1747-50 (Oct. 1982). [received: Sept. 1983]
The influence of complex additions containing Bi^{3+}, Nb^{5+} or W^{6+}, and other ions on the properties of piezoelectric ceramics based on lead titanate zirconate has been studied. It has been established that the introduction of additions with a number of compositions makes it possible to obtain ceramics with high characteristics ($\epsilon_{33}T/_{\epsilon 0}=1400$ to 5000, $K_p\geq 0.60$). (15 refs.)

119986 Material nonlinear piezoelectric coefficients for quartz. R.Brendel (Lab. de Phys. et Metrologie des Oscillateurs, Univ. de Franche-Comte Besancon, Besancon, France).
J. Appl. Phys. (USA), vol.54, no.9, p.5339-46 (Sept. 1983).
An electroelastic or polarizing effect can be used to obtain material nonlinear piezoelectric or electroelastic coefficients. It is shown that these material coefficients, obtained from general rotationally invariant nonlinear equations for small field superposed on a bias, differ from those obtained by using the phenomenological expansion of the effective elastic constants. The eight independent electroelastic coefficients listed here were calculated by using experimental data available in the literature. (16 refs.)

Propagation and amplification of surface waves in a thermopiezosemiconducting medium ....See Entry 119325

surface acoustic wave properties of thin film CdS prepared by hot wall technology ....See Entry 119326

Effect of prestressing on electrical breakdown in polyethylene at high temperature ....See Entry 119980

Exoemission method for detection of an insulating layer on the surface of a ferroelectric ....See Entry 120227

77.70 PYROELECTRIC AND ELECTROCALORIC EFFECTS

119987 Pyroelectric properties and domain structure of partly deuterated NH_4HSeO_4 crystals. H.Pykacz, J.Mroz (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland), Z.Czapla, O.Czupinski.
Acta Phys. Pol. A (Poland), vol.A64, no.3, p.285-7 (Sept. 1983).
The pyroelectric properties and domain structure were investigated of partly deuterated AHSe crystals grown from aqueous solutions containing 10, 20, 40, and 70% molar deuterium. These investigations confirmed the existence of the phase transition to the ferroelectric phase and to the low temperature phase in the crystals containing up to 40% molar deuterium. The phase transition temperature obtained from extrapolation for 100% D is shifted towards higher temperature by 27 deg. It is shown that crystals with 70% molar deuterium do not exhibit the ferroelectric properties along the *b*-axis and also the pyroelectric properties along the *c*-axis which for nondeuterated crystals are ferroelectric and pyroelectric axes respectively. (14 refs.)

119988 Relationship between the pyroelectric coefficient and the lattice dynamics of the pyroelectrics. N.D.Gavrilova, S.N.Drozhdin, V.K.Novik (Moscow State Univ., Moscow, USSR), E.G.Maksimov.
Solid State Commun. (USA), vol.48, no.2, p.129-33 (Oct. 1983).
The experimental results for a temperature dependence of the pyroelectric coefficient are represented for twenty different crystals in a wide temperature range. Current theories are used for an analytical fitting of this result. It is shown that in the ferroelectrics the pyroelectric coefficient γ^σ is defined mainly by optical phonon modes in comparison with the linear pyroelectrics in which γ^σ follows the T^3 law due to acoustic phonon. The possibility of an appearance of the linear temperature dependence of $\gamma^\sigma\approx T$ suggested by Born (1954) is discussed briefly. The experimental results show that such behavior indeed exists but only in very imperfect crystals and at very low temperatures. (21 refs.)

119989 Dielectric, pyroelectric, and magnetic properties of $BiMn_2O_5$ crystals. I.D.Zhitomirskii, N.E.Skorokhodov, A.A.Bush, O.I.Chechernikova, V.F.Chuprakov, Yu.N.Venevtsev (L.Ya. Karpov Physicochem. Sci.-Res. Inst., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.550-1 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.953-5 (March 1983). [received: Oct. 1983]
Crystals of $BiMn_2O_5$ exhibit antiferromagnetic ordering below 42K (Ref. 1). The presence of highly polarizable Bi^{3+} ions with an unshared electron pair in $BiMn_2O_5$ favors the appearance of special dielectric properties in this compound. The results of growth of $BiMn_2.O_5$ single crystals as well as of a study of their X-ray, dielectric, pyroelectric, and magnetic properties. (6 refs.)

Propagation and amplification of surface waves in a thermopiezosemiconducting medium ....See Entry 119325

Exoemission method for detection of an insulating layer on the surface of a ferroelectric ....See Entry 120227

77.80 FERROELECTRICITY AND ANTIFERROELECTRICITY

119990 Ferroelectricity and dielectric critical slowing-down in $LiNaGe_4O_9$ single crystal. M.Wada, M.Shibata, A.Sawada, Y.Ishibashi (Synthetic Crystal Res. Lab., Nagoya Univ., Nagoya, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.2981-2 (Sept. 1983).
Single crystals of $LiNaGe_4O_9$ were grown by the Czochralski technique from stoichiometric melt. It has been found that $LiNaGe_4O_9$ shows ferroelectric activity in the *a*-direction below $T_c=112.7$K. The spontaneous polarization is about 0.33 μC/cm^2 at 110.3K. The complex dielectric constants were measured at 120 Hz, 1 kHz and 10 kHz as functions of temperature. The dielectric dispersion has been found in the above frequency region and explained by the critical slowing-down of the polarization relaxation process. (2 refs.)

The first bilayer ferroelectric liquid crystal ....See Entry 118866

Solitons in ferroelectric liquid crystal ....See Entry 118885

Relationship between the pyroelectric coefficient and the lattice dynamics of the pyroelectrics ....See Entry 119988

Dielectric, pyroelectric, and magnetic properties of $BiMn_2O_5$ crystals ....See Entry 119989

Effect of an electric field on the low frequency Raman spectrum of $KNbO_3$ ....See Entry 120078

The field fluctuational model of thermally stimulated processes in ferroelectric $LiNbO_3$ ....See Entry 120167

Exoemission method for detection of an insulating layer on the surface of a ferroelectric ....See Entry 120227

Mixed crystals based on antimony niobate in the Sb_2O_3-Nb_2O_5-Sb_2O_5-KHF_2-H_2O_2-H_2O system ....See Entry 120232

Synthesis reaction of metatitanate $BaTiO_3$. I. Effect of the gaseous atmosphere upon the thermal evolution of the system $BaCO_3$-TiO_2 ....See Entry 120282

Micro-scaled spectral-resolved cathodoluminescence of grains in barium titanate ceramics ....See Entry 120457

77.80B Transitions and Curie point

119991 Investigation of ferroelectric phase transitions in powdered TGS using electroacoustic echo. I.L.Bajak, I.Turek, J.Vanco (Tech. Univ. of Transport & Telecommunications, Zilina, Czechoslovakia).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.5-6, p.307-14 (1983).
Ferroelectric phase transition in powdered triglycine sulphate is studied using electroacoustic echo at 35 MHz. Dynamical echoes of the 1st and 2nd orders as well as memory echo have been observed at room temperature. The temperature dependence of the relaxation time and the amplitude of the 1st order echo have been measured. It was shown that the Curie point in the powdered sample is shifted to a higher temperature. A ringing signal has been observed also in the paraelectric phase. The ringing signal in the paraelectric phase is very probably due to a quadrupole piezoelectric effect. (7 refs.)

119992 Ferroelectric properties of compounds with magnesium orthotellurate structure. L.I.Kosse, E.D.Politova, V.V.Chechkin, E.A.Myzgin, B.S.Medvedev, Yu.N.Venevtsev (L.Ya. Karpov Physicochem. Sci. Res. Inst., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1616-19 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1879-82 (Nov. 1982).
A complex experimental study has been carried out of the structures, phase transitions, and electrophysical properties of ceramic samples of the compounds Mg_3TeO_6, Mn_3TeO_6, $CdMn_2TeO_6$, and Cd_2MnTeO_6. It was concluded that the last three compounds are ferroelectrics with Curie points of 510, 570, and 400K and that a transition into a spontaneously polarized state takes place at 520K in the first compound. (7 refs.)

119993 Study of ferroelectric CsH_2PO_4 by the ultrasonic velocity and attenuation measurements. E.Kanda, A.Tamaki, T.Yamakami, T.Fujimura (Res. Inst. for the Sci. Measurements, Tohoku Univ., Sendai, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3085-92 (Sept. 1983).
The velocity V and the attenuation α of the longitudinal ultrasonic waves have been measured accurately near the ferroelectric phase transition temperature. Critical anomalies in the paraelectric phase were represented by $\Delta V \sim -\log(T-T_0)$ and $\sqrt{\Delta\alpha} \sim \log(T-T_0)$, where T_0 was determined from the simultaneously measured dielectric constant $\epsilon = C/(T-T_0)$. It was also found that the energy relaxation time τ_E varies as $\tau_E \sim (T-T_0)^{-1}$. This type of critical behavior is the same as that of the usual ferroelectrics. Thus it is concluded that the dipole-dipole interaction is dominant in the critical anomaly of the ultrasonic waves of CDP. Analysis of the attenuation based on the dynamical scaling law is also presented.

119994 Crystallographic changes characterizing the Curie transition in three ferroelectric copolymers of vinylidene fluoride and trifluoroethylene. I. As-crystallized samples. A.J.Lovinger (Bell Labs., Murray Hill, NJ, USA), T.Furukawa, G.T.Davis, M.G.Broadhurst.
Polymer (GB), vol.24, no.10, p.1225-32 (Oct. 1983).
Copolymers of vinylidene fluoride/trifluoroethylene of molar composition 65/35, 73/27 and 78/22% respectively, are ferroelectric and undergo a Curie transition to the paraelectric state at high temperatures. In contrast to the irregular structure found earlier for the 52/48 mol.% copolymer, the structures of these three compositions in the low-temperature state are well ordered and analogous to that of β-poly(vinylidene fluoride): they consist of molecular chains in a polar trans conformation whose order is improved with increasing vinylidene fluoride content, packed pseudo-hexagonally in unit cells whose dimensions decrease with increasing vinylidene fluoride content. In their paraelectric phase, the chains assume a partly disordered conformation consisting of irregular TG, $T\bar{G}$ and TT sequences and are packed on an expanded pseudo-hexagonal lattice. The Curie transitions were found to occur over a broad temperature range, encompassing ~30°C, and in the case of the 78/22 mol.% copolymer to extend into the melting region; they were also found to exhibit hysteresis by occurring at much lower temperatures upon cooling than upon heating. (21 refs.)

119995 Crystallographic changes characterizing the Curie transition in three ferroelectric copolymers of vinylidene fluoride and trifluoroethylene. II. Oriented or poled samples. A.J.Lovinger (Bell Labs., Murray Hill, NJ, USA), T.Furukawa, G.T.Davis, M.G.Broadhurst.
Polymer (GB), vol.24, no.10, p.1233-9 (Oct. 1983).
For pt.I see ibid., vol.24, no.10, p.1225-32 (1983). The effects of uniaxial drawing or poling on the structural changes involved in the ferroelectric-to-paraelectric phase transition in copolymers of vinylidene fluoride and trifluoroethylene were examined and compared to the behaviour of as-crystallized films. The compositions studied were 65/35, 73/27 and 78/22 mol.% vinylidene fluoride/trifluoroethylene, all of which crystallize from the melt with a molecular conformation and packing analogous to those of the common piezoelectric β-phase of poly(vinylidene fluoride). Contrary to the previously described behaviour of a 52/48 mol.% copolymer, orientation did not induce any significant changes in the structure of these copolymers or in its variation with temperature, primarily because these already crystallize directly from the melt in well-ordered, compact unit cells. The electrical poling caused the all-trans chains of the ferroelectric phase to be packed more compactly and to survive to higher temperatures, thus shifting the Curie transition closer to the melting points of these copolymers. As a result, competition from melting interfered with the later stages of this solid-state transformation in the 73/27 mol.% composition, and aborted it at a very early point in the 78/22 mol.% samples. The Curie temperature was found to exhibit hysteresis between heating and cooling parts of the thermal cycle, to extend over a broad range of temperatures, and to involve intramolecular changes to the same disordered conformation found in melt-crystallized samples. (18 refs.)

119996 Domain wall pinning by defects and the C-I transition. M.V.Feigel'man (L.D. Landau Inst. for Theoretical Phys., Moscow, USSR), I.F.Lyuksyutov.
Solid State Commun. (USA), vol.48, no.4, p.397-8 (Oct. 1983).
The influence of randomly distributed defects on domain wall fluctuations is investigated. These fluctuations lead to the long-range repulsion between domain walls resulting in the experimentally observed $n \sim \sqrt{|T-T_c|}$ behaviour of the domain wall density near the C-I transition. The impossibility of thermal depinning of one domain wall in the impurity potential is also shown. (10 refs.)

Ultrasonic investigations of incommensurate $(NH_4)_2BeF_4$ .... See Entry 119087

Effect of electric field on the lattice viscosity of doped displacive ferroelectrics .... See Entry 119122

Magnetic, elastic, and thermal properties of Rb_2NaHoF_6 ...... See Entry 119188

Band structure, spontaneous polarization and index of refraction above and below the Curie point of $BaTiO_3$ and $KNbO_3$ .... See Entry 119435

Pyroelectric properties and domain structure of partly deuterated NH_4HSeO_4 crystals .... See Entry 119987

Optical properties of ferroelectric $(Pb_{1-x}Ba_x)_5Ge_3O_{11}$ for x=0 and 0.02 .... See Entry 120007

Investigation of laser-induced luminescence and polarisation change in ferroelectric $AgNa(NO_2)_2$ in the time domain .... See Entry 120133

77.80D Domain structure and effects; hysteresis

119997 The hampered sideways motion of a single domain wall in Rochelle salt crystals. R.Styrkowiec (Inst. of Experimental Phys., Univ. of Wroclaw, Wroclaw, Poland).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K99-102 (Sept. 1983).
Domain wall displacement was caused in two ways: first by applying an external electric field (along the polarization direction) and second by applying unidirectional stress (in (001) direction). The electric field and external stress were gradually increasing. After each rise of electric field (or stress) the domain walls shifted by some distance and then stopped. In both cases slow changes of domain structures were observed. The displacement of walls was measured by means of a calibrated eyepiece. (27 refs.)

Magnetic, elastic, and thermal properties of Rb_2NaHoF_6 ...... See Entry 119188

Dielectric study of S_{A1}, S_{A2} and $S_{\tilde{A}}$ phases in liquid crystals of cyano compounds .... See Entry 119968

Pyroelectric properties and domain structure of partly deuterated NH_4HSeO_4 crystals .... See Entry 119987

Domain wall pinning by defects and the C-I transition .... See Entry 119996

Growth and investigation of $Ca_3(VO_4)_2$ .... See Entry 120237

77.90 OTHER TOPICS IN DIELECTRIC PROPERTIES AND MATERIALS

Importance of steric effects in the isotropic phase of nematogenic compounds .... See Entry 118879

Unified study of the lattice-mechanical properties of copper halide crystals .... See Entry 119132

78.00 OPTICAL PROPERTIES AND CONDENSED MATTER SPECTROSCOPY AND OTHER INTERACTIONS OF MATTER WITH PARTICLES AND RADIATION

(for phonon spectra, see 63.)

78.20 OPTICAL PROPERTIES AND MATERIALS

(see also 81.40T Optical properties related to materials treatment; for masers, and lasers see 42.52 and 42.55 respectively)

119998 Photogenerated gap states in polyacetylene. J.Orenstein (Bell Labs., Murray Hill, NJ, USA), G.L.Baker, Z.Vardeny.
J. Phys. Colloq. (France), vol.44, no.C-3, p.407-12 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Measures the optical absorption spectrum of photogenerated gap states in polyacetylene, $(CH)_x$. From a comparison with electroabsorption spectra the charge state of the excitations is determined. In both isomers of $(CH)_x$ locally neutral (exciton-like) states are observed. In addition a charged photocarrier, with optical absorption deep in the gap, is seen in trans-$(CH)_x$ only. (13 refs.)

119999 The effect of vibronic transition on the interband optical-absorption in $(CH)_x$. E.Ehrenfreund (Phys. Dept., Technion-Israel Inst. of Technol., Haifa, Israel), D.Moses, A.J.Heeger.
J. Phys. Colloq. (France), vol.44, no.C-3, p.491-3 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
A model for vibronic transitions in the quasi-one-dimensional semiconductor $(CH)_x$ is described. It appears that the resulting electron-phonon (e-p) coupling parameter is only a fraction of the e-p coupling constant responsible for the gap in $(CH)_x$. (7 refs.)

120000 Optical absorption in doped polyacetylene. M.Jestin, M.Kabbaj, J.P.Albert, C.Jouanin (Groupe d'Etudes des Semiconducteurs, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.499-502 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Optical absorption spectra of doped trans-polyacetylene are studied within the Su, Schrieffer and Heeger model (1979) assuming a regular lattice distribution of solitons induced by doping. (8 refs.)

Electronic correlations and midgap absorption in polyacetylene .... See Entry 119414

Polarons and solitons in trans-$(CH)_x$: an optical study .... See Entry 119474

Electrical, optical and glass transformation properties of amorphous solids—a review .... See Entry 119543

78.20B General theory (for pure homogeneous materials)

120001 On the Urbach rule. B.L.Gel'mont, V.I.Perel', I.N.Yassievich (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.415-18 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.727-33 (March 1983). [received: Oct. 1983]
Optical transitions between two electron states involving a photon energy deficit Δ are studied. An asymptotically exact value of the overlap integral is used to demonstrate that a model in which the upper and lower electron states correspond to adiabatic potentials (represented by parabolas with different frequencies but identical equilibrium positions) leads to the Urbach rule, i.e. the probability of an optical transition is given by $W \propto \exp(-\sigma\Delta/T)$. The temperature dependence of the parameter σ is determined. Optical transitions at low temperatures are due to subbarrier tunnelling. (16 refs.)

Instability of polaritons driven by infrared laser light .... See Entry 119121

78.20D Optical constants and parameters

120002 Optical absorption edge in $Hg_{0.7}Cd_{0.3}Te$. J.A.Mroczkowski, D.A.Nelson, R.Murosako, P.H.Zimmermann (Honeywell Electro-Optics Div., Lexington, MA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1756-60 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
Optical absorption measurements at the fundamental absorption edge in high purity and stoichiometrically doped p-type $Hg_{0.7}Cd_{0.3}Te$ show the absorption

edge to be significantly influenced by valence band tailing due to native Hg vacancy acceptor defects. The absorption coefficient α_e for transitions across the band gap increases as $\alpha_e=\alpha_0 \exp k(E-E_0)$; for high purity $Hg_{0.7}Cd_{0.3}Te$ at ambient temperatures $k=148$ eV^{-1}, this value decreases to $k=105$ eV^{-1} at acceptor concentrations of around 2×10^{16} cm^{-3}. (22 refs.)

120003 Absorption edge of tin disulfide single crystals. J.George, C.K.Valsala Kumari, K.S.Joseph (Dept. of Phys., Univ. of Cochin, Cochin, Kerala, India).

J. Appl. Phys. (USA), vol.54, no.9, p.5347-9 (Sept. 1983).

Absorption edge measurements in tin disulfide single crystals have been made. It is found that there is a shoulder in the absorption, just before the onset of band to band transitions, which is caused by transitions from the valence band to donor levels (due to a doubly ionizable sulfur vacancy) situated 0.17 eV below the conduction band. It is also found that there are three valence bands which originate by spin-orbit interaction and crystal field splitting. At room temperature (295K) the fundamental absorption starts at 2.070 ± 0.001 eV and the transition leading to this is an indirect forbidden one. The photoconductivity maxima, observed at 2.3 eV by earlier workers, is shown to be due to transitions from the third valence band to the conduction band. (19 refs.)

120004 Calculations of the mean-squared optical anisotropies of random-coil polypeptides. A.Lopez-Pineiro (Dept. de Quimica Fisica, Facultad de Ciencias, Univ. de Extremadura, Badajoz, Spain), M.P.Tarazona, E.Saiz.

J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.6, p.529-35 (June 1983).

Theoretical values of the mean-squared optical anisotropies $\langle\gamma^2\rangle$, of random-coil polypeptides of the twenty natural α-amino acids are calculated according to the valence optical scheme by the use of the rotational isomeric state model. The contribution of each repeat unit to the anisotropic part of the polarizability tensor of the chain $\hat{\alpha}_{=i}$ was computed by addition of previously optimized bond polarizabilities. Values of $\langle\gamma^2\rangle_1$ for single peptide units (identified for this calculation with molecules of the formula CH_3-CO-NH. CH_2R, where R is the side chain of each amino acid residue) range from 3.5 to 85.7 in units of 10^{-6}nm^6. The results of $\langle\gamma^2\rangle_x/x$ in the limit of $x\rightarrow\infty$ for homopolypeptides are roughly proportional to $\langle\gamma^2\rangle_1$ of the peptide unit. Ten actual proteins and three enzymes are also studied, their values of $\langle\gamma^2\rangle_x/x$ are almost identical and do not depend on the sequence of amino acids. (35 refs.)

120005 Anomalies in the optical and electrical properties of Cr-Al alloys. L.V.Nomerovannaya, V.A.Rassokhin (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).

Phys. Status Solidi a (Germany), vol.79, no.1, p.87-93 (Sept. 1983).

The frequency dependences of the real and imaginary parts of the complex dielectric constant in the spectral range of 0.069 to 5 eV and the temperature dependences of the resistance of the $Cr_{100-x}Al_x$ ($x\leq32$ at.% Al) alloy system are investigated. In alloys having 16 to 28 at.% of Al, a negative temperature coefficient of resistance, and a minimum metallic conductivity $\sigma(0)<1000$ Ω^{-1}, and a dielectrization of the optical properties is found, characterized by strong anomalous concentration and frequency dependences of the dielectric function in the infrared frequency range. From the analysis of the behaviour of the optical $\sigma(\omega)$ and the static $\sigma(0)$ conductivities it is concluded that the anomalies of optical and electrical properties result from the localization of free carriers near the Fermi level. (15 refs.)

120006 Crystalline ferroelectrics with glassy polarisation behaviour. G.Burns, F.H.Dacol (IBM Thomas J. Watson Res. Centre, Yorktown Heights, NY, USA).

Phys. Rev. B (USA), vol.28, no.5, p.2527-30 (1 Sept. 1983).

The authors report measurements of the optic index of refraction as a function of temperature, $n(T)$, in the crystalline ferroelectrics having the simple perovskite (ABO_3) structure. They show that these crystals possess a local, randomly oriented, nonreversible polarisation below a temperature T_d several hundred degrees above the ferroelectric phase-transition temperature T_c. Using a simple model, they account for this behaviour and understand quantitatively the values of T_d. This model, they believe, contains the basic physical understanding of ferroelectrics with a diffuse phase transition. (29 refs.)

120007 Optical properties of ferroelectric $(Pb_{1-x}Ba_x)_5$ Ge_3O_{11} for x=0 and 0.02. G.Burns, F.H.Dacol (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).

Phys. Rev. B (USA), vol.28, no.5, p.2531-4 (1 Sept. 1983).

The authors report accurate mesurements of the temperature dependence of the indices of refraction $[n(T)]$ in ferroelectric single crystals of $(Pb_{1-x}Ba_x)_5Ge_3O_{11}$ for $x=0$ and 0.02. Above the ferroelectric transition temperature T_c, $n(T)$ is linear with temperature. (It has been hoped that the $x=0.02$ sample would show nonlinear results similar to those observed in $BaTiO_3$.) Analyzing $n(T)$ below T_c in terms of the quadratic electro-optic effect, $[\Delta(n^{-2})]_{ij}=\Sigma_{k,l}g_{ijkl}P_kP_l$, reveals very large g values, 20-100 times larger than those observed in Pb perovskites. (18 refs.)

120008 Optical phenomena in $BaMnF_4$ near its phase-transition temperatures. R.V.Pisarev, B.B.Krichevtzov, P.A.Markovin, O.Yu.Korshunov (Ioffe Phys.-Tech. Inst., Acad. of Sci., Leningrad, USSR), J.F.Scott.

Phys. Rev. B (USA), vol.28, no.5, p.2677-85 (1 Sept. 1983).

Measurements of indices of refraction, birefringence, and rotation of the optical ellipsoid $BaMnF_4$ near its incommensurate structural phase-transition temperature and near its two- and three-dimensional magnetic-ordering temperatures have been made. The results are compatible with a single structural phase transition at $T_I=251$K for the sample used. Small jumps of all measured quantities have been found at T_I that proves the transition to be of first order. The point-group symmetry below T_I is shown to be 2 (C_2) or lower, as a result assumed before but never confirmed directly. The optical ellipsoid rotates $\sim4'$ as temperature is lowered below T_I. Optical activity tensor component $G_{33}=5\times10^{-5}$ was measured below T_I. Quite unexpectedly the rotation of the optical ellipsoid and the optical activity were found to be temperature independent. Contrary to that, the anomalous part of the index of refractive close to T_I varies with temperatures as $\langle(\zeta^2+\eta^2)\rangle$ in both phases, where ζ and η are components of the order parameter. In the high-temperature phase $Ama2_1$ ($C_{2v}{}^{12}$) close to T_I this varies as $(T-T_I)^{1/2}$ in agreement with theoretical estimations. Fluctuational contributions to the indices of refraction and to the birefringence persist up to $\sim$350K. In the low-temperature phase the order-parameter contribution to the index of refraction is found to vary with the critical exponent $\beta=0.28$. The magnetic contribution to the refractive index at low temperatures is obtained, the highest value being $\sigma n_c\simeq1\times10^{-3}$. (26 refs.)

120009 Parametric distortion of the optical-absorption coefficient of semiconductors by an additional infrared laser. R.M.O.Galvao, L.C.M.Miranda (Divisao de Fisica Teorica, Inst. de Estudos Avancados, Centro Tecnico Aeroespacial, Sao Paulo, Brazil).

Phys. Rev. B (USA), vol.28, no.6, p.3593-6 (15 Sept. 1983).

The distortion of the optical-absorption coefficient of a direct-gap semiconductor is investigated when the semiconductor is subjected to an additional IR laser field. It is shown that, when the IR laser intensity increases, the absorption coefficient develops a tail below the zero-field gap. An application is made for the case of InSb irradiated by an intense CO_2 laser. (15 refs.)

120010 Investigation of the optical absorption of doped rutile. V.M.Arutyunyan, A.O.Arakelyan, G.A.Kurbatov, Zh.R.Panosyan, A.G.Sarkisyan, K.K.Sidorin, Yu.V.Shmartsev (State Univ., Erevan, USSR).

Sov. Phys.-Solid State (USA), vol.25, no.3, p.543-4 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.942-4 (March 1983). [received: Oct. 1983]

The authors report the results of an investigation of the spectral dependence of the optical absorption coefficient (α) of single-crystal and polycrystalline samples of rutile both undoped and doped with chromium, vanadium, and aluminum. The spectral dependences of α for rutile single crystals were obtained in a wide spectral range where α varied from about 10^6 cm^{-1} to 1 cm^{-1}. (11 refs.)

120011 Optical properties of $In_{0.5}Ga_{0.5}P$ epitaxial films. D.Z.Garbuzov, E.V.Tulashvili, V.P.Evtikhiev, I.N.Arsent'ev (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).

Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.551-2 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1281-5 (Nov. 1982). [received: Sept. 1983]

The authors report a study of the spectra of the refractive index and absorption coefficient for $h\nu<Eg$ in $In_{0.5}Ga_{0.5}P$ solid solutions. This material has attracted interest because of its direct gap structure with a gap size $E_g{}^{\Gamma}=1.9$ eV (300K). The $In_{0.5}Ga_{0.5}P$ lattice constant is the same as that of GaAs, substantially simplifying the procedure for fabricating $In_{0.5}Ga_{0.5}P$ epitaxial films. The specific technique used to synthesize $In_{0.5}Ga_{0.5}P$ epitaxial films on GaAs substrates by liquid-phase epitaxy has been described previously along with the luminescence properties of these films. There is, however, essentially no information available on the spectra of the refractive index or the absorption coefficient for $In_{0.5}Ga_{0.5}P$ epitaxial films. The present experiments were carried out to bridge this gap and to compare the optical properties of $In_{0.5}Ga_{0.5}P$ with those of $A^{III}B^V$ binary compounds. (6 refs.)

120012 Opalescence in $Na_{0.5}Bi_{0.5}TiO_3$ crystals. I.P.Pronin, P.P.Syrnikov, V.A.Isupov, G.A.Smolenskii (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).

Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.563-4 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1309-12 (Nov. 1982). [received: Sept. 1983]

Sodium bismuth titanate, $Na_{0.5}Bi_{0.5}TiO_3$ (NBT), is one of the complex perovskites in which identical crystal sites are occupied by ions of different species with difference valences. The most interesting aspect of the behavior of NBT is the onset of isotropy in this crystal at a certain temperature in the antiferroelectric region. At the isotropy temperature there is a very pronounced thermal hysteresis (on the order of 50°C). Single crystals of NBT, greenish-yellow in color, are opalescent at room temperature. It was observed visually that these crystals become transparent when heated. Since there is essentially no change in color, it was suggested that there is a change in the intensity of the light scattering. For a more objective estimate of the scattering the authors studied the temperature dependence of the optical transmission. They assumed that, whatever the contributions of the reflection and the absorption, they are relatively small and vary monotonically with the temperature. Accordingly, the transmission curves can be used to determine the change in the light scattering intensity with temperature. (6 refs.)

120013 On the optic-refractometric regularity of nonmetal isotropic substances. A.N.Borets.

Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1346-50 (Sept. 1983). In Russian.

The validity of optic-refractometric (OR) correlation is demonstrated on examples of 25 nonmetal substances. The OR correlation is more general and precise than other known relations. The OR-parameter (quasi-constant) η_3 practically coincides with the inverse value of the correction factor α in Slater's Xα-method. The OR-regularity of dispersion in a high-energy part of transparent region and the OR-criterion of nonmetallicity are discussed. (19 refs.)

120014 On refractometric evaluation of properties of boundary layers of elastomers. L.M.Pritykin, V.L.Vakula.

Vysokomol. Soedin. Ser. A (USSR), vol.25, no.9, p.1887-91 (Sept. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*

The method of calculation of density and coefficient of packing of elastomers in boundary layers is proposed based on ellipsometric measuring of refraction indexes on the interface. The relation of found characteristics with properties of elastomers in interphase and on the boundary with air is discussed. The proposed approach permits to be obtained the quantitative information about the behaviour of elastomers in conditions of interphase contact. (15 refs.)

120015 On the applicability of electron dynamic models for determining the refractive index of mixtures. W.Burckhardt, P.Bussemer, U.Deitrich (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).

Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.87-91 (1983). In English.

Experimental values of the optical index of glasses in two special binary compositions are compared with the predictions of electrodynamic models. The agreement is rather good for the composition As_2S_3-As_2Se_3 (uniform short range order). Deviations occur at the composition As_2Se_3-Se which are due to differences in the short-range order of the two original substances. (7 refs.)

120016 Electrodynamic models for the optical refractive index and their application to binary mixtures. U.Deitrich, P.Bussemer (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).

Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.93-8 (1983). In English.

Different macroscopic-electrodynamical models for the calculation of the dielectric function $\bar{\epsilon}(\omega,x)$ of a mixture (ω: frequency, x: composition) are discussed using a unifying point of view starting from the relationship between the macroscopic field E and the internal field E^{int}. Onsager's model of dipole coupling allows a direct derivation of the effective medium approximation (EMA) for binary mixtures. (16 refs.)

Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride ....See Entry 116917

Spindle stage studies on HMX and AP ....See Entry 117230

Particle characterization by PLM. II. Single polar ....See Entry 117231

Generalized dispersion relation for optical constants ....See Entry 118071

Picosecond shadow spectroscopy and refractive-index nonlinearity in semiconductors ....See Entry 118199

Non-linear susceptibility of Langmuir-Blodgett polydiacetylene thin films ....See Entry 118212

TeO_x thin films for an optical disc memory ....See Entry 118237

Effect of thermal stress on the homogeneity of optical glasses .... See Entry 118238

Properties and structure of glasses in the system 10K_2O·20Ba0·70(SiO_2, GeO_2,B_2O_3) .... See Entry 118897

Melt growth and properties of B_6P crystals .... See Entry 118928

Characteristics of the crystals of derivatives of 12CaO.7Al_2O_3 .... See Entry 118949

Doping kinetics of polyacetylene in the short range .... See Entry 119042

Radiation damage and near-edge optical properties of ion-implanted gallium arsenide .... See Entry 119047

Structural and optical studies of topotaxially-grown Cu_2S from sprayed CdS thin films .... See Entry 119374

Trends in optical parameters and band structure with increasing hydrogenation of amorphous silicon .... See Entry 119418

Band structure, spontaneous polarization and index of refraction above and below the Curie point of $BaTiO_3$ and $KNbO_3$ .... See Entry 119435

Theoretical and experimental investigation of the optical properties of mixed-valence compound SmB_6 .... See Entry 119436

Optical study of electron localization approaching a polarization catastrophe in liquid K_x-KCl_{1-x} .... See Entry 119456

Virtual surface plasmons in cylinders .... See Entry 119491

Ionic limit in graphite-fluoroarsenate intercalation compounds .... See Entry 119538

Compensation densities in n-type $Hg_{1-x}Cd_xTe$ from transport properties of optically generated free carriers .... See Entry 119624

Comparison of optically modulated absorption and photoconductivity decay lifetime measurements on HgCdTe .... See Entry 119625

Wide optical gap, undoped, photoconductive a-Si_xN_{1-x}:H prepared by DC sputtering .... See Entry 119662

Ion plated transparent conductive films .... See Entry 119732

The isotropic hyperfine interaction in ternary complexes of copper(II) with 8-hydroxyquinoline and various salicyclic acids .... See Entry 119904

High-pressure optical absorption and X-ray-diffraction studies in RbI and KI approaching the metallization transition .... See Entry 120021

An investigation of the far infrared optical properties of $Hg_{1-x}Cd_xTe$ .... See Entry 120042

Infrared reflectance and absorption of n-type InP .... See Entry 120052

Infrared and optical properties of $TMTSF_2X$ .... See Entry 120067

Importance of temperature-dependent optical properties for Raman-temperature measurements for silicon .... See Entry 120086

Light scattering from a Na_2O-SiO_2 glass with metastable phase separation .... See Entry 120105

Methods of determining optical constants of thin semiconductor films using normal incidence reflectance and transmittance data .... See Entry 120171

Optical properties of laser-melt-quenched Au-Si alloys .... See Entry 120173

Vapour phase growth of arsenic chalcogenide crystals and their characterization .... See Entry 120230

Selective solvation of polystyrene in tetralin/cyclohexane mixtures .... See Entry 120620

78.20E Optical rotatory power

120017 Studies in some physical properties of amino acids. I. Specific rotations, apparent molal volumes and adiabatic compressibilities of *l*-amino acids in mixed solvents. D.V.Jahagirdar, S.U.Pankanti (Chem. Dept., Marathwada Univ., Aurangabad, India).
Indian J. Chem. A, vol.22A, no.3, p.195-7 (March 1983). [received: Oct. 1983]
Specific rotations, apparent molal volumes (ϕ_v) and adiabatic compressibilities (ϕ_{Ks}) have been determined for a few *l*-amino acids in aqueous solutions and in water-dioxane mixtures. The change in specific rotation is not identical for isodielectric mixtures, viz. ethanol-water, methanol-water and dioxane-water. The ϕ_v and ϕ_{Ks} have been utilised to calculate the hydration number (n_H) of *l*-tryptophan in 10, 20 and 40% dioxane-water mixtures. The n_H values obtained by the two methods show satisfactory agreement and point out that in the initial stages of addition to water, dioxane does not interfere in the primary hydration of *l*-tryptophan. (5 refs.)

Effects of a magnetic field on the optical properties of dielectric mirrors .... See Entry 118241

Optical phenomena in $BaMnF_4$ near its phase-transition temperatures .... See Entry 120008

78.20F Birefringence

(inc. stress birefringence, flow birefringence, etc)

120018 Picosecond photoinduced optical anisotropy in trans-$(CH)_x$: direct measurement of soliton diffusion. Z.Vardeny (Dept. of Phys., Brown Univ., Providence, RI, USA), J.Strait, D.Moses, T.-C.Chung, A.J.Heeger.
J. Phys. Colloq. (France), vol.44, no.C-3, p.403-5 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Photoinduced dichroism caused by bleaching of the interband transition in trans-$(CH)_x$ was observed in the picosecond time domain. The bleaching is induced instantaneously and decays with time as $t^{-1/2}$, changing to a lower power after ~ 50 ps. Although the photoinduced bleaching persists to long times, polarization memory is lost after~10^{-9} s. The results provide a measurement of the diffusion constant of the charged excitations; $D \simeq 2 \times 10^{-2}$ cm^2 s^{-1} at 300K and 80K. (10 refs.)

120019 Applications of the modulated liquid crystal-linear dichroism (LC-LD) to spectro- and stereo-chemical problems. III. B.Samori (Facolta di Chimica Industriale, Bologna, Italy).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.385-97 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
For pt.II see J. Chem. Soc. Perkin Trans., vol.2, p.446 (1982). The instrument, apparatus, and some new details the set-up for measurements using LC-LD techniques are reported. Some applications of LC-LD information previously published by the author are collected and reviewed in order to give some examples of the usefulness of the technique in solving spectro- and stereo-chemical problems. The manner in which LC-LD information about the symmetry of electronic states can be applied both to assign electronic transitions and demonstrate that a molecule that is achiral in its electronic ground state can become chiral in an excited state, is presented. Distortions induced in solute molecules by liquid crystalline solvents can be demonstrated by LC-LD, and stereochemical models of induction of cholesteric mesophase have been proposed on the basis of LC-LD orientational information. (16 refs.)

120020 Orientation and relaxation in uniaxially stretched atactic polystyrene. D.Lefebvre, B.Jasse, L.Monnerie (Lab. de Phys.-chimie Structurale et Macromoleculaire, Ecole Superieure de Phys. et de Chimie Industrielles de la Ville de Paris, Paris, France).
Polymer (GB), vol.24, no.10, p.1240-4 (Oct. 1983).
Infrared measurements of the dichroic ratio of atactic polystyrene absorption bands provide a valuable method of determination of orientation as well as relaxation of chains during stretching. Different strain rates and temperatures of stretching were used. Orientation relaxation was analysed using Lodge's (1956) constitutive equation and a master curve was obtained at a reference temperature T_0=115°C. Orientation relaxation behaves similarly to mechanical relaxation and a scaling factor of 3.6×10^{-8} m^2 N^{-1} holds between the two sets of results. (16 refs.)

Particle characterization by PLM. II. Single polar .... See Entry 117231

Orientation of molecules of epoxide oligomers in a uniform stationary magnetic field .... See Entry 118023

Diffusion of fluorine ions in yttrium iron garnet .... See Entry 119266

Random-field critical behaviour of a $d=3$ Ising system .... See Entry 119863

Optical phenomena in $BaMnF_4$ near its phase-transition temperatures .... See Entry 120008

Electrogyration in $AgGaS_2$ and $CdGa_2S_4$ crystals .... See Entry 120030

78.20H Piezo-, elasto- and acousto-optical effects

120021 High-pressure optical absorption and X-ray-diffraction studies in RbI and KI approaching the metallization transition. K.Asaumi, T.Suzuki, T.Mori (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Phys. Rev. B (USA), vol.28, no.6, p.3529-33 (15 Sept. 1983).
The pressure dependence of the fundamental optical absorption edges in RbI and KI crystals has been investigated up to 70 GPa at room temperature by using high-pressure apparatus of sapphire and diamond anvil types. The absorption edges in RbI and KI are found to show some complicated behaviors below ~5 GPa within the UV region. Beyond ~5 GPa, absorption edges decrease monotonically with increasing pressure up to 70 GPa. The X-ray-diffraction study shows that the CsCl-type crystal structure remains stable up to 67 GPa after the NaCl- to CsCl-type phase transition at 0.4 GPa for RbI and at 1.9 GPa for KI, respectively. The metallization pressures of RbI and KI are estimated to be approximately 85 and 115 GPa, respectively. (12 refs.)

120022 Influence of the polarization of injection laser radiation on the efficiency of the acoustooptic interaction in anisotropic crystals. V.A.Kondrat'ev, V.N.Morozov, Yu.M.Popov, G.I.Semenov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.387-8 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR),* vol.10, no.3, p.638-40 (March 1983). [received: Oct. 1983]
A study was made of the polarization characteristics of the radiation emitted by double-heterostructure AlGaAs injection lasers and of the influence of these characteristics on the efficiency of scattering of laser radiation by volume acoustic waves in a crystal of paratellurite. The efficiency of the acoustooptic interaction increased linearly on increase in the degree of linear polarization of the incident radiation. When the plane of polarization of this radiation was rotated relative to the scattering plane by 90° from the optimal position, the efficiency of this interaction was more than halved. The central frequency of an ultrasonic cell for the interaction with radiation of wavelength $\lambda=0.9$ μ was 50 MHz and the efficiency of the interaction was ~50%. (3 refs.)

Carbon-related vibronic bands in electron-irradiated silicon ...See Entry 119070

78.20J Electro-optical effects

120023 Comparative studies of mercury cadmium telluride single crystal and epitaxial. P.M.Raccah, U.Lee (Univ. of Illinois, Chicago, IL, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1587-92 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
The authors have carried out a systematic study of mercury cadmium telluride (MCT), bulk single crystal and epilayers, using electrolyte electroreflectance (EER). Their results, and others discussed here, suggest that much of the unusual properties of this material are due to structural microdomains. Under mechanical stresses or chemical attack, the walls of these domains tend to move via the generation and propagation of defects associated with cationic diffusion. A typical consequence is the creation of *n*-type zones within a *p*-type matrix. They have calibrated their etch rate so as to be able to apply EER to the study of the profiles of epilayers with a depth resolution of 200 Å. The technique was applied to more than 100 samples of all origins. The results are summarized here in qualitative terms, such as typical profile features, as well as in quantitative terms, such as compositional variations and defect densities. EER results are integrated within the conceptual framework introduced above and compared to SIMS and microprobe results. (19 refs.)

120024 Computer simulation of a nematic guest-host display. F.Gharadjedaghi (ASULAB SA, Neuchatel, Switzerland).
J. Appl. Phys. (USA), vol.54, no.9, p.4989-93 (Sept. 1983).
The steady state electrooptical behavior of a dichroic type of display cell using a nematic mixture with positive dielectric anisotropy is considered. This study makes use of a mathematical simulation method. Numerical results obtained from this method are in very good agreement with experiment. The effect of physical and technological parameters of the system on the form of the transmission-voltage characteristic is studied and in particular the slope of this characteristic in the neighborhood of the threshold voltage. The role played by the twist angle is especially considered. (10 refs.)

120025 Electrooptical properties of thin films of polyheterocycles. M.Gazard, J.C.Dubois, M.Champagne, F.Garnier, G.Tourillon (Thomson-CSF Lab., Domaine de Corbeville, Orsay, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.537-42 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Some conducting polyheterocycles prepared by electroinitiated polymerization as thin films on electrodes change colour reversibly when they are electrochemically cycled. As an example, polypyrrole is synthetized in an oxidized form and may be reduced reversibly between 0 and 0.7 volt vs. SCE. The modified electrode changes from brown to yellow during the cycling of the potential. Other colors may be obtained with other heterocycles. The electrochemical properties of some polyheterocylces have been determined and their characteristics—optical density, switching speed, ageing effects—are compared to those of other electrochromic organic materials. (11 refs.)

120026 Electro-optical behavior of a novel strong-weak and weak-weak anchored large-pitch cholesteric. H.P.Hinov, E.Kukleva, A.I.Derzhanski (Inst. of Solid State Phys., Sofia, Bulgaria).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.109-24 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The electro-optical behavior of strong-strong, strong-weak and weak-weak anchored tilted and reversely-tilted large-pitch cholesterics has been investigated. The weak anchoring has been achieved after rubbing with soap the previously mechanically-rubbed glass plates. Under a voltage excitation, the most important reversely-tilted weak-weak anchored cholesteric layers giving rise to a nearly-planar Grandjean-like texture showed the appearance of a Helfrich's instability, followed by a $\pi/2$ rotation of the helix and finally, a scroll texture which compactly disappeared into a completely unwinded cholesteric. When voltage was switched off, the unwinded cholesteric was returned to the initial Grandjean-like texture for the case of a low voltage ($U<3U_{th}$, where U_{th} is the threshold voltage for the Helfrich's instability) or has been transformed into a finger-print texture for higher voltages. This novel boundary-induced bi-stability is related to the weakness of the surface anchoring. In addition, attention has been paid on the important electro-optical behavior of the well-known, however insufficiently investigated, finger-print texture embedded into a homeotropic matrix. (70 refs.)

120027 Two-photon interband absorption of light in semiconductors in external parallel electric and magnetic fields. P.K.Katana (V.I. Lenin State Univ., Kishinev, USSR).
Phys. Status Solidi b (Germany), vol.119, no.1, p.89-98 (1 Sept. 1983).
The constant of the two-photon interband absorption of light (TPA) in a semiconductor placed in external, parallel quantizing electric and magnetic fields is calculated. It is shown that the TPA constant near each Landau level must have an oscillatory behaviour due the presence of discrete Stark levels, that is, at high electric field strengths the 'Stark ladder' must be observed. The following particular cases are considered: the one-photon absorption (OPA), the two-photon electro-absorption (TPEA), and the two photon magnetoabsorption (TPMA). (20 refs.)

120028 Kerr constants of random coil polypeptides. A.Lopez-Pineiro (Dept. de Quimica Fisica, Univ. de Extremadura, Badajoz, Spain), M.P.Tarazona, E.Saiz.
Polym. Bull. (Germany), vol.10, no.7-8, p.373-80 (Sept. 1983).
Calculations of average molar Kerr constants $<_mK>$ of polypeptides of the twenty natural α-aminoacids in the random coil state are presented. The computation was carried out according to the rotational isomeric states model with the values of energies, dipole moments and optical anisotropies of the repeating units reported elsewhere. In the case of homopolypeptides, the ratios $<_mK>/x$ extrapolated to $x \rightarrow \infty$ range approximately from -6000 to $+5000$ in units of $10^{-27} V^{-2} m^5 mol^{-1}$. Results obtained for ten actual proteins and three enzymes in the random coil state are also reported; their values of $<_mK>/x$ are very sensitive to the kind of aminoacid residues and to the sequence of those residues. (15 refs.)

120029 Numerical investigation of the plasma electroreflectance model at lead and indium electrodes. E.M.Podgaetskii, M.I.Urbakh (Inst. of Electrochem., Acad. of Sci., Moscow, USSR).
Sov. Electrochem. (USA), vol.19, no.1, p.55-60 (Jan. 1983). Translation of: *Elektrokhimiya (USSR)*, vol.19, no.1, p.61-6 (Jan. 1983). [received: Sept. 1983]
The plasma electroreflectance mechanism is discussed for lead and indium electrodes in terms of a microscopic theory of light reflection from metals. The calculation is performed for s- and p-polarized light. It is shown that the electroreflectance signal obtained in p-polarized light is determined, not only by the double-layer capacitance but also by the potential dependence of the characteristic length of electron density decay outside the metal. The results of the numerical calculations are compared with experimental data. (14 refs.)

120030 Electrogyration in $AgGaS_2$ and $CdGa_2S_4$ crystals. O.G.Vlokh, A.V.Tsarik, I.M.Nekrasova.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1334-8 (Sept. 1983). In Russian.
Electrogyration coefficients γ_{41} are determined for $AgGaS_2$ and $CdGa_2S_4$ crystals at wavelengths of 498 and 489 nm, which correspond to inversion points of the birefringence sign: $\gamma_{41}=2.03.10^{-12}$ m/V and $\gamma_{41}=1.52\times10^{-12}$ m/V. (10 refs.)

Electrohydrodynamic behavior in twisted-wedge nematic structures .... See Entry 118873

'Acceptor' and 'donor' excitons bound to transition-metal impurities in II-VI semiconductors .... See Entry 119466

Optical properties of ferroelectric $(Pb_{1-x}Ba_x)_5$ Ge_3O_{11} for $x=0$ and 0.02 .... See Entry 120007

Poly(2,2′-bithiophene): an electrochromic conducting polymer .... See Entry 120107

Electroreflectance and crystal structure of thin zinc sulfide films .... See Entry 120170

Physical and electrochemichromic properties of RF sputtered tungsten oxide films .... See Entry 120172

Comparative determination of the size of disk-shape colloid particles by conventional and electric light scattering .... See Entry 120682

78.20L Magneto-optical effects

120031 The low triplet state of tetramethyl-1,3-cyclobutanedithione. III. Single-crystal Zeeman spectroscopy. J.Baiardo, M.Vala (Dept. of Chem., Univ. of Florida, Gainesville, FL, USA), I.Trabjerg.
Chem. Phys. (Netherlands), vol.80, no.3, p.305-15 (15 Oct. 1983).
For pt.II see ibid., vol.79, p.403 (1983). Pulsed, high-field Zeeman spectra of the lowest singlet-to-triplet transition in single-crystal tetramethyl-1,3-cyclobutanedithione (TMCBDT) have been measured. The analysis of the spectra was performed using an extension of the theory of Casto and Hochstrasser (1968) which allows for an arbitrary alignment of the magnetic field with respect to the principal crystal axes. The authors provide evidence that in TMCBDT (1) the lowest triplet is ^3A_u (D_{2h} molecular symmetry), (2) only one spin-orbit coupling route is active, (3) a substantial zero-field splitting (2.5 ± 1.0 cm^{-1}) is present, (4) the magnetic and molecular axes are rotated by 90°,and (5) the spin-orbit contribution to the triplet-state g value is small compared to its effect on the zero-field splitting parameters. (13 refs.)

120032 Spin-orbit splitting of Γ exciton bands in RbI and KI. R.Onaka, H.Iwamoto (Inst. of Appl. Phys., Univ. of Tsukuba, Ibaraki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3248-53 (Sept. 1983).
The exciton absorption bands in Rb and KI are studied by means of magnetic circular dichroism spectra, and their effective g-values are obtained. From the sign of the g_{eff}-values, it is concluded that the lowest two sharp absorption bands, E_1 and E_2, are $(\Gamma_8{}^-; \Gamma_6{}^+)$ and $(\Gamma_6{}^-; \Gamma_6{}^+)$ excitons, respectively, which are split by the spin-orbit interaction of iodine $5p$ electrons. The higher energy bands, E_3 and E_4, are probably the exciton bands produced by excitation of halogen $5p$ electrons to the d-like conduction bands at X and L points in the Brillouin zone. (14 refs.)

120033 On the optimum method of analysis of Faraday rotation and ellipticity measurements in a metal-oxide-semiconductor system. R.F.O'Connell, G.Wallace (Dept. of Phys. & Astron., Louisiana State Univ., Baton Rouge, LA, USA).
J. Phys. & Chem. Solids (GB), vol.44, no.10, p.951-3 (1983).
The authors have previously calculated the Faraday rotation θ and ellipticity δ due to the two-dimensional electron gas at the oxide-semiconductor interface of a metal-oxide-semiconductor system. The results depend on such parameters of the system as the effective mass m^*, the relaxation time τ, and the electron surface concentration N, and in fact the motivation is to enable one to determine such parameters from measurements of θ and δ. Here they discuss the optimum method for the determination of these parameters from the data. In particular, they argue that it is more desirable to carry out measurements at fixed magnetic field B and variable photon frequency w, rather than at fixed w and variable B. They also demonstrate how the analysis can be used to determine the predicted dependence of τ on magnetic field, without explicit knowledge of m^* or N. (10 refs.)

120034 Relationship between Faraday rotation and Hall effect in amorphous rare-earth-transition-metal alloys. M.Hartmann (Philips Res. Labs., Hamburg, Germany), T.R.McGuire.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1194-7 (26 Sept. 1983).
The Faraday rotation and spontaneous Hall effect were investigated in amorphous thin films with compositions $(GdFe)_{1-x}M_x$ (M=Bi, Sn, Au). Bismuth and tin are found to increase the Faraday rotation, ϕ_F, the Hall resistivity, ρ_H, and the sample resistivity, ρ, while Au decreases ϕ_F, ρ_H, and ρ as compared to values observed for GdFe. Specifically, ϕ_F is proportional to the Hall angle (ρ_H/ρ). A model first proposed by Voigt is developed to account for this proportionality. (25 refs.)

120035 Identification of residual donors in high-purity epitaxial GaAs with the use of magneto-optical spectroscopy. D.C.Reynolds, K.K.Bajaj, C.W.Litton, E.B.Smith (US Air Force Wright Aeronautical Labs., Wright-Patterson Air Force Base, OH, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3300-5 (15 Sept. 1983).
The authors report the first identification of residual donors in high-purity vapor-phase epitaxial GaAs using the photoluminescence technique in the presence of applied magnetic fields. Identifications were made from complexes of the neutral-donor-bound-exciton type in which the transitions occurred between excited initial and final states of the complex. The same residual donors were identified from ionized-donor-bound-exciton complexes in the same crystal. These measurements were also made in applied magnetic fields. The magnetic field compresses the wave function which sharpens the optical transitions. It also separates the diffferent donors when viewed from neutral-donor-bound-exciton transitions. The magnetic field separation of different donors, when viewed from the ionized-donor-bound-exciton transitions, was not significant in fields up to 40 kG. An exchange energy of $\sim$30 μV was measured from the magnetic field splitting of the ionized-donor-bound-exciton π lines. (32 refs.)

Rare earth Faraday rotator materials for lasers .... See Entry 118175

Effects of a magnetic field on the optical properties of dielectric mirrors .... See Entry 118241

Diffusion of fluorine ions in yttrium iron garnet .... See Entry 119266

Formation of an array of magnetic bubbles in ferrite garnet films .... See Entry 119884

Nonlinear effects in the electron-nuclear spin system of a semiconductor following absorption of light of variable circular polarization ....See Entry 119953

Two-photon interband absorption of light in semiconductors in external parallel electric and magnetic fields .... See Entry 120027

78.20N Thermo-optical effects

120036 On the use of the thermal lens effect as a thermo-optical spectroscopy of solids. L.C.M.Miranda (Inst. de Estudos Avancados, Centro Tecnico Aeroespacial, Sao Jose dos Campos, Brazil).
Appl. Phys. A (Germany), vol.A32, no.2, p.87-93 (Oct. 1983).
A theoretical model for the thermal lens effect due to the absorption of modulated light by a solid is presented. The discussion includes an analysis of the modulation frequency response of the temperature rise in the solid. It is suggested that this effect may be used as a new technique for studying the thermo-optic properties of solids. (18 refs.)

120037 Fundamental optical properties of In halides. A.Borghesi, G.Guizzetti, L.Nosenzo, E.Reguzzoni, A.Stella (Dipartimento Fisica 'A. volta', Univ. di Pavia, Pavia, Italy), F.Levy.
Solid State Commun. (USA), vol.48, no.4, p.345-8 (Oct. 1983).
Reflectance and thermoreflectance spectra between 2 and 9 ev have been measured for InBr and InI crystals. A correlation between optical structures and electronic levels is proposed taking into account the X-ray photoelectron spectroscopy data and the expected similarity of In and Tl halides band scheme. (20 refs.)

78.30 INFRARED AND RAMAN SPECTRA AND SCATTERING

120038 Use of CuO in obtaining approximate depolarization ratios of colorless solids. D.P.Strommen, K.Nakamoto (Dept. of Chem., Marquette Univ., Milwaukee, WI, USA).

Appl. Spectrosc. (USA), vol.37, no.5, p.436-9 (Sept.-Oct. 1983).

The authors have developed a new method by which approximate depolarization ratios may be determined for colorless compounds in the solid state. Through the addition of CuO or carbon black, they were able to obtain reasonable values for vibrational modes of K_2SO_4, $Na[Ag(CN)_2]$, $W(CO)_6$, and benzophenone. The function of these colored additives appears to be that of reducing the depth of penetration of the laser beam and consequently attenuating the amount of reflected or refracted radiation which will have been scrambled with respect to polarization. (10 refs.)

120039 Raman spectra of sodium sulphamate single crystal. P.Muthusubramanian, A.Sundara Raj (School of Phys., Madurai Kamaraj Univ., Madurai, India).

Can. J. Chem. (Canada), vol.61, no.9, p.2048-52 (Sept. 1983).

Vibrational assignments are proposed for solid $NaNH_2SO_3$ on the basis of room temperature polarized Raman spectra of single crystals. Infrared data for the region 4000-50 cm $^{-1}$ of the polycrystalline sample are also presented. The results indicate that (1) there is no water of crystallization, (2) the hydrogen bonding is extremely weak, and (3) the strength of N-S bond is stronger than in sulphamic acid. (14 refs.)

120040 Surface-enhanced Raman spectroscopy of water: implications of the electromagnetic model. C.G.Blatchford, M.Kerker, D.-S.Wang (Clarkson Coll. of Technol., Potsdam, NY, USA).

Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.230-5 (9 Sept. 1983).

The electromagnetic model of surface-enhanced Raman scattering is used to show that in colloidal sols the failure to observe enhanced Raman signals from adsorbed water or even from a macroscopic layer of water near the surface is due not only to the small Raman cross section of water and the fact that any such enhanced signal is overwhelmed by that from the bulk water, but also because of the high wave number of the vibrational mode of water. (39 refs.)

120041 The role of cavity sites in surface-enhanced Raman scattering. H.Seki, T.J.Chuang (IBM Res. Lab., San Jose, CA, USA).

Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.393-6 (23 Sept. 1983).

Thermal desorption spectra (TDS) of pyridine from silver films deposited in ultra high vacuum are reported. Marked differences in the TDS are seen depending on the deposition conditions and the thermal history of the films, which have been correlated with surface-enhanced Raman scattering (SERS). These results as well as some of the observations in electrochemical systems are discussed in light of the recent Xe probe analysis carried out by Albano et al. (36 refs.)

120042 An investigation of the far infrared optical properties of $Hg_{1-x}Cd_xTe$. T.N.Casselman, G.L.Hansen (Honeywell Corporate Technol. Center, Bloomington, MN, USA).

J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1683-6 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).

Details results of a study of the optical absorption spectrum of *n*- and *p*-type $Hg_{1-x}Cd_xTe$ for wavelengths from below the band gap to 40 μm. The authors identify both intervalence band and multiphonon lattice absorption in the data, and have tentatively identified free electron absorption using Jensen's (1982) theoretical model. The intervalence band absorption data are compared to the predictions of a theoretical model. Tentative phonon frequency assignments are made for some of the more prominent multiphonon peaks. (7 refs.)

120043 Raman scattering in $Hg_{0.8}Cd_{0.2}Te$. P.M.Amirtharaj, Kwong-Kau Tiong, F.H.Pollak (Phys. Dept., Brooklyn Coll., City Univ. of New York, New York, NY, USA).

J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1744-8 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).

The authors report the first polarization dependent Raman scattering study in $Hg_{0.8}Cd_{0.2}Te$ from the (100) and (111) faces. The Raman spectra were recorded in the back scattering geometry at 77K using several lines of an Ar^+ laser near resonance with the E_1 optical gap. The study leads to an unambiguous identification of the HgTe and CdTe-like transverse optical (TO) and longitudinal optical (LO) phonon features. The HgTe-like TO and LO phonons occur at 122 ± 1 cm^{-1} and 140 ± 1 cm^{-1} and the CdTe-like LO phonon occurs at 156 ± 1 cm^{-1}; the CdTe-like TO-LO splitting was too small to be observable. The presence of a symmetry forbidden HgTe-like TO phonon from the (100) face indicates the presence of defects or disorder. A defect mode was observed at ~ 108 cm^{-1}. In addition, an extremely surface sensitive feature was seen at 132 cm^{-1} and has been tentatively assigned to a coupled LO phonon-intersubband excitation from the natural occurring surface inversion layer. A strong feature observed at 135 cm^{-1} may arise from clustering effects. (15 refs.)

120044 The effects of ion-implantation damage on the first-order Raman spectra of GaP. D.R.Myers, P.L.Gourley, P.S.Peercy (Sandia Nat. Labs., Albuquerque, NM, USA).

J. Appl. Phys. (USA), vol.54, no.9, p.5032-8 (Sept. 1983).

The authors have analyzed the effects of ion-implantation-induced damage on the first-order Raman spectra of GaP, and have correlated changes in the Raman spectra with direct measurements of implantation-induced surface stresses. The authors find that, at low ion fluences, the effects of implantation damage are to produce point defects that remove free carriers from doped material and to produce stresses in the undamaged regions. In this regime, the stress-induced shifts of the Raman lines can be predicted from the known elastic constants of undamaged GaP. At intermediate fluences, implantation damage alters the elastic properties of GaP so that the stress-induced shifts of the Raman lines are less than those predicted from the properties of the undamaged crystal. At higher doses, implantation-induced surface stresses exceed the elastic limit of the damaged material. This plastic deformation of the implanted surface is accompanied by a rapid broadening of the phonon lines in the first-order Raman spectra. (31 refs.)

120045 Characterization of transplutonium orthophosphates and trimetaphosphates by Raman spectrophotometry. D.E.Hobart (Dept. of Chem., Univ. of Tennessee, Knoxville, TN, USA), G.M.Begun, R.G.Haire, H.E.Hellwege.

J. Less-Common Met. (Switzerland), vol.93, no.2, p.359 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).

Summary form only given. The authors study multimicrogram samples of crystalline transplutonium (Am-Es) orthophosphates and trimetaphosphates by Raman spectroscopy. The positions and relative intensities of the Raman spectra peaks obtained from the transplutonium orthophosphates were found to be quite similar to those of the lighter lanthanide (La-Gd) monoclinic orthophosphates and quite different from those of the heavier lanthanide (Tb-Lu) tetragonal orthophosphates. Also, Raman spectra of the trimetaphosphates were discernible from the Raman spectra of the orthophosphates. By applying the correlations established from Raman studies of the lanthanide orthophosphates and trimetaphosphates to the transplutonium compounds, it was possible (1) to assign the major Raman bands to specific phosphate vibrational frequencies, (2) to identify the stoichiometry and/or composition of the phosphate compounds and (3) to confirm the crystal environment of the compound. In addition to the above assessments, it was also possible to determine the presence of and follow the in-growth (via radioactive decay) of $^{249}BkPO_4$ into samples of $^{253}EsPO_4$ using the laser-excited fluorescence of the berkelium. (1 ref.)

120046 Vibrational study of the $[P_2S_6{}^{4-}]$ anion, of some MPS$_3$ layered compounds (M=Fe, Co, Ni, In$_{2/3}$), and of their intercalates with $[Co(\eta^5\text{-}C_5H_5)_2{}^+]$ cations. C.Sourisseau, J.P.Forgerit (Lab. de Spectrochemie et Raman, CNRS, Thias, France), Y.Mathey.

J. Solid State Chem. (USA), vol.49, no.2, p.134-49 (Sept. 1983).

The infrared and Raman spectra [10-3100 cm^{-1}] have been recorded for aqueous solutions and polycrystalling samples of $Na_4P_2S_6.6H_2O$ as well as for several lamellar MPS$_3$ (or $M_2P_2S_6$) compounds with M=Fe, Co, Ni, In$_{2/3}$ and their intercalates with cobalticenium cations. A complete assignment of the observed spectra is proposed and a normal coordinate analysis of the $[P_2S_6{}^{4-}]$ anion is carried out; this allows proposal of a new assignment, for the spectra of the layered MPS$_3$ host systems which is slightly modified with respect to prior work. A detailed analysis of the infrared and far-infrared spectra is also reported for the intercalates with $[Co(\eta^5\text{-}C_5H_5)_2{}^+]$ cations. From these results, it is concluded that the mechanism of the electronic transfer during the intercalation process depends on the nature of the metal: when M=Co or Ni the main reduction site is that P-P bond while when M=Fe (and perhaps also Mn) the reduction involves mainly the metal ion itself. (33 refs.)

120047 Infrared spectra of Cs_3CoCl_5. M.Natarajan, J.Quinn, E.A.Secco (Dept. of Chem., St. Francis Xavier Univ., Antigonish, Nova Scotia, Canada).

J. Solid State Chem. (USA), vol.49, no.2, p.258-61 (Sept. 1983).

The infrared spectra, transmittance, and polarized reflectance of Cs_3CoCl_5 are reported. The group theoretical analysis was executed and a vibrational assignment proposed on the basis of D_{4h} symmetry. Factor group and site effects are discussed. (8 refs.)

120048 Infrared study of the adsorption of $^{16}O_2$, $^{16}O^{18}O$ and $^{18}O_2$ on Cr_2O_3. P.J.M.Carrott, N.Sheppard (School of Chem. Sci., Univ. of East Anglia, Norwich, England).

J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.10, p.2425-37 (Oct. 1983).

Absorption bands occur between 1030 and 850 cm^{-1} from the adsorption of oxygen $^{16}O_2$ on amorphous Cr_2O_3 and on crystalline α-Cr_2O_3 prepared according to the method of Zecchina et al. (1971). Broad overlapping absorptions occur for oxygen adsorbed on the amorphous oxide and multiple resolvable bands occur for crystalline α-Cr_2O_3. Through adsorption of pure $^{16}O_2$, pure $^{18}O_2$ and the $^{16}O_2 + ^{16}O^{18}O + ^{18}O_2$ equilibrium mixture it is clearly shown that all these absorptions arise from mono-oxygen surface species, probably approximating to Cr=O, on different sites. No bands from dioxygen species were observed. (17 refs.)

120049 Infrared spectroscopic study of pyridine adsorption on $MoO_3.NiO$ catalysts supported on fluorinated γ-Al_2O_3. L.G.Tejuca, C.H.Rochester (Dept. of Chem., Univ. of Dundee, Dundee, Scotland), A.L.Agudo, J.L.G.Fierro.

J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.10, p.2543-58 (Oct. 1983).

Infrared spectra of adsorbed pyridine have been used to characterize Bronsted and Lewis acidic sites on fluorinated γ-Al_2O_3 (Al samples) and on $MoO_3.NiO$ supported on fluorinated γ-Al_2O_3 (MoNiAl samples). The Bronsted acidity of MoNiAl samples increased with increasing fluorine content. Also MoNiAl exhibited higher Bronsted acidity, but lower ability to form hydrogen bonds with pyridine, than Al samples. Partial desorption of pyridine at 673-873K revealed the presence of acid centres of different strengths. The strongest acid centres were probably associated with higher oxidation states of Mo or Ni. (21 refs.)

120050 Infrared studies of the effect of preadsorbed pyridine on the oxidation of butan-2-ol adsorbed on TiO_2. T.Nakajima, H.Miyata, Y.Kubokawa (Dept. of Appl. Chem., Univ. of Osaka Prefecture, Osaka, Japan).

J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.10, p.2559-68 (Oct. 1983).

The influence of preadsorbed pyridine on the adsorption, dehydration and dehydrogenation of butan-2-ol on TiO_2 has been investigated by i.r. spectroscopy as well as by an analysis of the reaction products. Both reactions proceed via formation of butoxide species. In the presence of oxygen the major products from the butoxide are butenes, the formation of butanone being minor. The preadsorbed pyridine inhibits butene formation, while enhancing that of butan-2-one. In the absence of oxygen, only butenes are formed. On strong acid sites butanone formation is suppressed, butene formation being predominant. Adsorbed oxygen induces the production of basic sites which bring about butan-2-one formation. On weak acid sites butanone formation is the major reaction. (27 refs.)

120051 Laser Raman scattering spectroscopy of crystals. M.M.Sushchinskii, V.S.Gorelik.

J. Appl. Spectrosc. (USA), vol.38, no.1, p.80-93 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.91-110 (Jan. 1983). (40 refs.)

120052 Infrared reflectance and absorption of n-type InP. O.K.Kim, W.A.Bonner (Bell Labs., Murray Hill, NJ, USA).

J. Electron. Mater. (USA), vol.12, no.5, p.827-36 (Sept. 1983).

It has been shown that measurement of the infrared reflectance minimum frequency offers a simple, non-destructive method to determine carrier densities of n-type InP. Free carrier absorption has been measured for InP with carrier densities of $0.4\text{-}9 \times 10^{18}/cm^3$ in the spectral range of 1.1-10 μm and discussed in terms of optical phonon scattering and impurity scattering. In particular, the absorption at $\lambda = 1.3$ μm should be considered in the design of long wavelength photodetectors and light emitting diodes to improve external quantum efficiencies. (15 refs.)

120053 Preparation and properties of high quality polyacetylene. P.Knoll, H.Kuzmany, P.Surjan, M.Kertesz (Inst. fur Festkorperphys., Univ. of Vienna, Vienna, Austria).

J. Phys. Colloq. (France), vol.44, no.C-3, p.155-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).

By very careful sample preparation a trans-polyacetylene film was grown which showed an unusual weak high frequency component in the C=C stretch mode Raman line if excited with 4579 Å laser light. This is good evidence that the dispersion effect is of extrinsic origin rather than due to hot luminescence from long undisturbed conjugations. Degradation of the sample by irradiation hardly changes the line shape of the modes but increases the background scattering whereas oxidation enhances the high frequency part of the C=C stretch mode. A calculation of Raman line shapes within an extended version of the interrupted conjugation model gave very good agreement with experimental results and proved the very strong square root-like dependence of the transition matrix elements on the number of double bonds at least for short and medium long segments. (12 refs.)

120054 Doping and degradation of polyacetylene by nitric acid. D.Billaud, M.A.Haleem (Lab. de Chimie du Solide Mineral, Univ. de Nancy I, Nancy, France), S.Lefrant, S.Krichene.
J. Phys. Colloq. (France), vol.44, no.C-3, p.175-8 (June 1983). In French. (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The reaction of HNO_3 on trans $(CH)_x$ leads to two different reactions (doping and degradation) which have been followed by various physical measurements: variation in time of the electrical resistivity, IR and Raman spectroscopies and EPR. (5 refs.)

120055 Resonance Raman scattering induced by polyacetylene and derivatives. S.Lefrant (Lab. de Phys. Cristalline, Univ. de Paris-Sud, Orsay, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.247-54 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Recalls the main results obtained in Raman scattering on polyacetylene $(CH)_x$, cis or trans, and concentrates on the experimental point of view. New results are presented, essentially coming from the use of new excitation wavelengths, in the deep red region (λ_L=752.5 nm), and in the UV range (λ_L=333.6 nm). These results are discussed with the use of the theoretical models proposed by other authors. (22 refs.)

120056 Structural aspects of polyacetylene from resonance Raman scattering. H.Kuzmany (Inst. fur Festkorperphys., Univ. Wien, Wien, Austria).
J. Phys. Colloq. (France), vol.44, no.C-3, p.255-60 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The dispersion effect of resonance Raman scattering in trans-$(CH)_x$ is analysed within a model where the polymer consists of a distribution of undisturbed conjugations along the chains. The model is justified by the strong sample dependence of the dispersion and by the good agreement between calculated and observed line shapes. From the analysis of high quality samples 50% of the material was found to be in segments longer than 25 double bonds. Doping cis-$(CH)_x$ with AsF_5 is shown to induce isomerization and disorder. For more than 5% doping isomerization is complete and the resonance effect disappears from the highly doped crystalline areas. (17 refs.)

120057 Structural properties of trans $(CH)_x$ from absorption and resonant Raman scattering spectra analysis. G.P.Brivio, E.Mulazzi (Dipartimento di Fisica, Univ. di Milano, Milano, Italy).
J. Phys. Colloq. (France), vol.44, no.C-3, p.261-5 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
A theoretical analysis of structural properties of trans$(CH)_x$ from resonant Raman scattering spectra is presented, taking into account the contribution of long and short conjugation length chains. (7 refs.)

120058 Near IR-optical absorption of undoped and doped $(CH)_x$. H.Kiess, G.Harbeke, B.J.Curtis, R.Keller (Labs. RCA Ltd., Zurich, Switzerland).
J. Phys. Colloq. (France), vol.44, no.C-3, p.285-9 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The IR absorbance of undoped and weakly F, Cl, Br and I doped polyacetylene was measured in the spectral region from 0.125 to 1.05 eV. Doping induced absorption bands are observed which are not in quantitative agreement with existing soliton theory in terms of band position and magnitude of absorption. In addition the authors find very narrow metastable lines, in particular for doping with chlorine, at photon energies between 0.55 and 0.95 eV depending on the level of electrical conductivity. (9 refs.)

120059 Photo induced infrared active phonons in trans polyacetylene. Z.Vardeny, J.Orenstein, G.L.Baker (Phys. Dept., Technion-Israel Inst. of Technol., Haifa, Israel), J.Orenstein, G.L.Baker.
J. Phys. Colloq. (France), vol.44, no.C-3, p.325-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors measured photogenerated IR active phonons in trans-$(CH)_x$ by the photoinduced absorption technique. A correlation was found to exist with a photoinduced absorption band in which electronic transitions are involved. The results show photoproduction of free charged defects with long lifetimes. (16 refs.)

120060 Dispersion curves and resonant Raman spectrum of trans polyacetylene. R.Tubino (Istituto di Chimica delle Macromolecole, CNR, Milano, Italy), L.Piseri, G.Dellepiane, P.Piaggio.
J. Phys. Colloq. (France), vol.44, no.C-3, p.329-32 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The lattice dynamics of trans-polyacetylene is discussed and compared with the vibrational C=C and C—C stretching frequencies of short polyenes. The widths, the shape and the position of the Raman bands and their variation with the laser frequency are interpreted in terms of the lattice dynamical model. Some consideration on the selective resonant enhancement as a function of the lifetime of the photoexcitation are also presented. (12 refs.)

120061 Extended range optical absorption spectra of electrochemically doped trans $(CH)_x$. T.E.Jones, J.C.Hicks, D.L.Stierwalt, D.M.Cavanaugh, D.M.Gottfredson (Naval Ocean Systems Center, San Diego, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.333-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Thin (1000 Å) films of $(CH)_x$ were grown on KBr substrates to allow extended range optical absorption measurements to be performed from approximately 0.04 eV to 2.5 eV (300 cm^{-1} to 20000 cm^{-1}). Doping with ClO_4^- and AsF_6^- was performed and the IR spectral features were correlated with the midgap absorption and the interband transition. (10 refs.)

120062 Raman study of doped polyacetylenes. E.Faulques, S.Lefrant (Lab. de Phys. Cristalline, CNRS, Univ. de Paris-Sud, Orsay, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.337-40 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors present Raman scattering results obtained on doped polyacetylene films, using a variety of dopants including electron acceptors (I_2, Br_2, SbF_5, ClO_4, $FeCl_3$) and electron donors (Li for example). They show that a cis-trans isomerization is always induced upon doping. Compared to an undoped trans-$(CH)_x$, the doping process leads to a shortening of the trans sequences, if the model of the chain length distributions is valid. For all doped samples, an additional band is observed close to the C=C stretch Raman band at about 1600 cm^{-1}. (10 refs.)

120063 Optical properties of heavily doped polyacetylene films. O.Bernard (Groupe de Dynamique des Phases Condensees, Univ. de Sci. et Technol. du Languedoc, France), M.Palpacuer, C.Benoit, M.Rolland, M.J.M.Abadie.
J. Phys. Colloq. (France), vol.44, no.C-3, p.345-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The infrared transmission of thin films of polyacetylene has been measured for various doping levels ($0 \leq \gamma \leq 7\%$). The analysis of results shows that modes ω_1 (1400 cm^{-1}) and ω_2 (900 cm^{-1}) arising from structural defects are stable for $\gamma > 2\%$, and they persist in the metallic state. The authors show that ω_2 mode cannot be the pinned mode. (8 refs.)

120064 Raman scattering induced by undoped and doped polyparaphenylene. S.Krichene (Lab. de Physique Cristalline, CNRS, Univ. de Paris-Sud, Orsay, France), S.Lefrant, G.Froyer, F.Maurice, Y.Pelous.
J. Phys. Colloq. (France), vol.44, no.C-3, p.733-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Raman scattering results on polyparaphenylene samples prepared by two different methods are presented. The best spectra are obtained with an excitation wavelength in the UV range and the Raman bands are peaked at 1216 cm^{-1}, 1276 cm^{-1} and 1598 cm^{-1} for λ_L=334.8 nm. A comparison with Raman spectra induced by oligomers leads to a correlation between the intensity of the Raman band at $\simeq$1220 cm^{-1} and the number of phenyl rings present in the studied material. (5 refs.)

120065 Poly(para phenylene): Some properties related to the synthesis method. G.Froyer, J.Goblot, J.L.Guilbert, F.Maurice, Y.Pelous (CNET, Lannion B-ROC/TIC, Lannion, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.745-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Poly(para phenylene) can be obtained by different methods. The authors show the difference between two materials in terms of optical absorption, IR spectroscopy, DC conductivity and AsF_5 doping. According to these converging results, the chains of the polymer obtained by the Yamamoto method are shorter than those of the Kovacic polymer. (7 refs.)

120066 Vibrational spectra and structure of undoped and doped polyparaphenylene. Z.Iqbal (Inst. of Inorganic Chem., Univ. of Zurich, Zurich, Switzerland), H.Bill, R.H.Baughman.
J. Phys. Colloq. (France), vol.44, no.C-3, p.761-4 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Infrared and Raman spectroscopic data on undoped and AsF_5-doped polyparaphenylene (PPP), are presented. The results are discussed in terms of the normal mode calculation of Rakovic et al. (1982) and the bipolaron defect model of the doped polymer proposed by Bredas et al. (1982). (9 refs.)

120067 Infrared and optical properties of $TMTSF_2X$. C.S.Jacobsen (Phys. Lab. III, Tech. Univ. of Denmark, Lyngby, Denmark), D.B.Tanner, K.Bechgaard.
J. Phys. Colloq. (France), vol.44, no.C-3, p.859-65 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Some infrared and optical properties of the $TMTSF_2X$-materials are presented with special emphasis on the derivation of band structure parameters. The infrared conductivity of $TMTSF_2PF_6$ reflects the electron molecular vibration coupling, but also contains several unexplained features. (12 refs.)

120068 Far-infrared properties of $(TMTSF)_2ClO_4$ at low temperatures. H.K.Ng, T.Timusk (Dept. of Phys., McMaster Univ., Hamilton, Ontario, Canada), K.Bechgaard.
J. Phys. Colloq. (France), vol.44, no.C-3, p.867-72 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors report on a study of the reflectance of $(TMTSF)_2ClO_4$ in the spectral region 5-400 cm^{-1} between 2K and 58K. Kramers-Kroning analysis of the data shows that there is a region of low conductivity below 30 cm^{-1} in the *a* direction. There are two peaks (7 cm^{-1} and 25 cm^{-1}) in this gaplike region and one at 25 cm^{-1} is destroyed by a magnetic field of 2 kgauss. They attribute the region of high conductivity above 30 cm^{-1} to the Holstein process of phonon emission. (17 refs.)

120069 Far infrared properties of $(TMTSF)_2ClO_4$. W.A.Challener, P.L.Richards (Lawrence Berkeley Labs., Univ. of California, Berkeley, CA, USA), R.L.Greene.
J. Phys. Colloq. (France), vol.44, no.C-3, p.873-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The far infrared properties of $(TMTSF)_2ClO_4$ have been measured for frequencies between 4 and 40 cm^{-1}. At 2K, phonon-like peaks in reflectance are seen at 7 and 29 cm^{-1}. Increasing the temperature to 80K causes these peaks to gradually disappear, but not to shift appreciably in frequency. Radiation-induced defects substantially reduce the height of the 29 cm^{-1} peak. Experiments at 2.3K and 4.2K show no change in the 29 cm^{-1} peak with a magnetic field of up to 40 kG applied parallel to the c*-axis. These results suggest a coupled electronic-molecular vibration origin for these features. They are incompatible with the recently proposed interpretation of the 29

cm^{-1} feature as a quasione-dimensional superconductive pseudogap. (13 refs.)

120070 Peierls instability of the organic linear chain semiconductor TEA $(TCNQ)_2$ [Raman study]. E.F.Steigmeier, H.Auderset (Labs. RCA Ltd., Zurich, Switzerland), D.Baeriswyl, M.Almeida, K.Carneiro.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1445-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Raman spectra are reported on the organic linear chain semiconductor TEA $(TCNQ)_2$ between 4 and 300K. From the coupling coefficient, mostly of intermolecular modes, a measure for the order parameter variation of the Peierls distortion with temperature is derived. It shows a transition (3-dimensional ordering temperature T_{3d}) near 300K. The correlation of Raman with infrared results suggests a value of 1000 cm^{-1} (125 meV) for the Peierls pseudogap at 300K. (15 refs.)

120071 Infrared studies of phase transitions in single- and two-chain organic charge transfer conductors. R.Bozio, C.Pecile, P.Tosi (Inst. of Phys. Chem., Univ. of Padova, Padova, Italy).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1453-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The vibronic infrared absorptions of $MEM(TCNQ)_2$ are discussed in relation to the electronic- and spin-Peierls transitions and to the structural disorder. The roles of the donor and acceptor chains in the Peierls transitions of TMTTF-TCNQ, and HMTTF-TCNQ are demonstrated. (8 refs.)

120072 Spectral studies of the phase transitions in $MTPP(TCNQ)_2$ and $MEM(TCNQ)_2$. R.Swietlik, A.Graja (Inst. of the Molecular Phys., Polish Acad. of Sci., Posnan, Poland).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1457-60 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Infrared reflection and absorption spectra have been used to study the phase transitions in $MTPP(TCNQ)_2$ and $MEM(TCNQ)_2$ salts. The pronounced spectral changes due to the phase transition has been related to the observed spectral modifications. (13 refs.)

120073 Plasma reflectance of the one-dimensional organic metals of the type $(arene)_2XF_6$(arene=perylene, pyrene or fluoranthene; X=P, As, Sb). H.P.Geserich, B.Koch, W.Ruppel, R.Wilckens (Inst. fur Angewandte Phys., Univ. Karlsruhe, Karlsruhe, Germany), D.Schweitzer, V.Enkelmann, G.Wegner, G.Weiners, H.J.Keller.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1461-4 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors have investigated the spectral position and the form of the plasma edge of different radical cation salts of the type $(arene)_2XF_6$ as a function of the type of the organic donor molecule, and of the charge transfer between donor and acceptor molecules. (11 refs.)

120074 Far-infrared properties of trimethylammonium idodide tetracyanoquinodimethane. J.E.Eldridge, N.Fortier, F.E.Bates (Phys. Dept., Univ. of British Columbia, Vancouver, BC, Canada), J.S.Miller.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1465-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The authors present the powder absorption spectrum of (TMA)(I)(TCNQ) in the far-infrared as a function of temperature. Below 160K new absorption features appear and others increase in intensity. This behaviour supports the electron and neutron diffraction evidence of a distortion on the TCNQ chains below the first phase transition temperature of 159K (in the deuterated sample). (16 refs.)

120075 The low-temperature optical properties of TTF-TCNQ in the far-infrared. J.E.Eldridge, F.E.Bates (Phys. Dept., Univ. of British Columbia, Vancouver, BC, Canada).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1469-72 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The bolometric response of a crystal of TTF-TCNQ has been used to give indirectly the reflectivity R at 12K. The optical properties have been obtained from a Kramers Kronig analysis. The conductivity shows a strong resonance at 35 cm^{-1} attributed to the phase mode of the pinned charge-density wave, and strong mid-gap absorption due possibly to solitons. The calculated absorption coefficient agrees with that measured for powdered samples. (9 refs.)

120076 Vibrational spectroscopy of mixed stack organic semiconductors: comparison with segregated stack systems. A.Girlando, C.Pecile, A.Painelli (Inst. of Phys. Chem., Univ. of Padova, Padova, Italy).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1547-50 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The effects of the electron-molecular vibration interaction on the vibrational spectra of organic semiconductors with different type of stack are reviewed. The perturbation due to such interaction on the Raman frequencies of compounds characterized by regular mixed stack structure is shown. (9 refs.)

120077 The effect of substituents at benzoic ring on the parameters of cholesteryl benzoates infrared spectra in phase transitions. A.D.Laskovetz, I.I.Gorina, L.S.Gorbatenko, I.G.Chistyakov, G.V.Mikhailenko (Inst. of Crystallography, Acad. of Sci., Moscow, USSR).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.175-82 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Infrared spectra of cholesteryl benzoates, ortho and para Br cholesteryl benzoates, para ethoxy cholesteryl benzoates in crystalline, cholesteric and isotropic states as well as in dilute carbon chloride solutions have been obtained. The behavior of the absorption band of carbonyl group (C=O) stretching vibrations in cholesteryl benzoates was investigated. The results obtained are indicative of the strengthening of local intermolecular interactions in the cholesteric phase. (13 refs.)

120078 Effect of an electric field on the low frequency Raman spectrum of $KNbO_3$. T.Shigenari (Dept. of Engng. Phys., Univ. of Electro-Communications, Tokyo, Japan).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.63-5 (3 Oct. 1983).
The effect of an electric field on the low-frequency B_2 mode at 56 cm^{-1} in a $KNbO_3$ crystal has been observed as a small shift of the frequency in Raman spectrum. It means that the mode is not due to the disorder-induced TA modes with a flat dispersion but is a Brillouin zone center optical mode. However, the mode does not show clear ferroelectric soft-mode behavior as usually observed in other ferroelectrics. (7 refs.)

120079 Photoinduced IR-active vibrations in trans-$(CD)_x$: a three-mode system. Z.Vardeny (Dept. of Phys., Solid State Inst. Technion, Haifa, Israel).
Phys. Rev. Lett. (USA), vol.51, no.13, p.1221 (26 Sept. 1983).
In a recent letter Blanchet et al. (1983) extended photoinduced absorption measurements of trans-polyacetylene to lower energy than obtained before, see Vandeny et al. (1983), for both isotopes, $(CH)_x$ and $(CD)_x$. While in (CH_x) three strong IR-active vibrations (IRAV) are photoinduced, only two IRAV were observed in $(CD)_x$, at $\omega_1=400$ cm^{-1} and at $\omega_2=1045$ cm^{-1}. This appeared strange, since from doping-induced IRAV and from resonant Raman scattering (RRS) it is known that $(CD)_x$ is also a three-mode system. Because of the asymmetry of the mode at 1045 cm^{-1}, it was suggested that two vibrations may be contained in this line, but high-resolution examination of the line failed to resolve it. The authors report a high-resolution photoinduced absorption measurement of $(CD)_x$ at 80K obtained with a double integration technique using a setup described before, see Vardeny et al. (1983), in which the authors have observed the third IRAV in $(CD)_x$. (4 refs.)

120080 Raman scattering resonant with quasi-two-dimensional excitons in semiconductor quantum wells. J.E.Zucker (Columbia Univ., New York, NY, USA), A.Pinczuk, D.S.Chemla, A.Gossard, W.Wiegmann.
Phys. Rev. Lett. (USA), vol.51, no.14, p.1293-6 (3 Oct. 1983).
Raman scattering resonant with quasi-two-dimensional excitons in GaAs-(Al_xGa_{1-x})As heterostructures shows enhancement profiles in agreement with exciton structure measured in other optical spectra. The profiles have characteristic asymmetries in the incoming and outgoing resonances that are specific to the exciton-optical-phonon interaction in quantum wells. Direct evidence of the degree of exciton confinement appears in the Raman spectra. (25 refs.)

120081 Interference between allowed and forbidden Raman scattering by longitudinal-optical phonons in GaAs. J.Menendez, M.Cardona (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Phys. Rev. Lett. (USA), vol.51, no.14, p.1297-9 (3 Oct. 1983).
The amplitudes for the allowed and the forbidden (intraband Frolich) scattering by LO phonons are shown to interfere near resonances. This fact is illustrated with measurements on a (100) surface near the $E_0{}^+\Delta_0$ gap of GaAs. (13 refs.)

120082 Plasma reflection and hole optical effective mass in p-HgTe. V.I.Ivanov-Omskii, A.Sh.Mekhtiev, S.A.Rustambekova, E.N.Ukraintsev (Space Res. Sci. Industrial Enterprise, Acad. of Sci., Baku, Azerbaijan SSR).
Phys. Status Solidi b (Germany), vol.119, no.1, p.159-69 (1 Sept. 1983).
The results of plasma reflection investigations in p-HgTe are decribed. It is show, that the plasma reflection spectrum shift towards small energies and the decrease of their depths with increasing temperature cannot be explained by the dielectric anomaly of the zero gap semiconductor due to the $\Gamma_8 \rightarrow \Gamma_8$ transition only. The analysis of the experimental results shows that the optical effective mass value has both, a temperature and concentration dependence. Such a dependence may be explained in the frame of the Kane theory, if the renormalization of the energy-spectrum of holes due to exchange electron-electron interaction is taken into account. (28 refs.)

120083 Comparison of fast electron and thermal annealing of proton bombarded silicon-X-ray and IR spectroscopy study. K.Biskupska, J.Tatarakiewicz, K.Wieteska (Inst. of Nuclear Res., Swierk, Poland).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K13-15 (Sept. 1983).
This note is the continuation of the authors' previous X-ray and IR spectroscopy study (see ibid., vol.66, p.K101, 1981) of thermal annealing of some silane band intensities and changes in contrast shape of proton bombarded silicon. They have noticed that a 600°C annealing step leads to the microscopic deformation of the sample. They present more details of their results as compared with fast electron annealing. Dislocation-free, 5 Ωcm, P-doped silicon single crystals were used. 9 MeV proton implantations were carried out at the INR linear accelerator ANDRZEJ. (4 refs.)

120084 Theory of far-infrared absorption in superconducting composites. J.Garner, D.Stroud (Dept. of Phys., Ohio State Univ., Columbus, OH, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2447-51 (1 Sept. 1983).
A simple model is described for the frequency-dependent conductivity of normal-superconducting composites. The superconducting component is characterised by the Mattis-Bardeen conductivity, and the composite conductivity is determined via the effective-medium approximation. Near the percolation threshold p_c there is strong absorption below twice the superconducting gap. Scaling arguments indicate that the authors' results have validity beyond mean-field theory. The model is in qualitative agreement with recent experiments on granular NbN films. (31 refs.)

120085 Raman studies of vitreous SiO_2 versus fictive temperature. A.E.Geissberger, F.L.Galeener (Palo Alto Res. Center, Palo Alto, CA, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3266-71 (15 Sept. 1983).
The first-order Raman spectra of vitreous SiO_2 have been studied as a function of sample fictive temperature T_F for $900°C \leq T_F \leq 1550°C$. Three observations were made: (1) The broad features assigned to vibrations associated with the continuous random network of v-SiO_2 shift in frequency in a manner consistent with densification by reduction of the average Si-O-Si angle θ; (2) the sharp 'defect' lines at 492 and 606 cm^{-1} show little or no shift in frequency; (3) both defect line intensities exhibit Arrhenius behavior, $\exp(-\Delta E/k_B T_F)$, with well-defined activation energies ΔE of 0.14 and 0.40 eV, respectively. These observations are interpreted using a central-force network dynamics model and changes in the number of planar threefold and regular fourfold ring defects. (18 refs.)

120086 Importance of temperature-dependent optical properties for Raman-temperature measurements for silicon. G.E.Jellison, D.H.Lowndes, R.F.Wood (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3272-6 (15 Sept. 1983).
A standard relation of Raman scattering in the resonant regime is that the Raman matrix element R is well represented by $K\, d\epsilon/dE$, where ϵ is the dielectric function, E is the photon energy, and K is a constant. However, the only experimental check of this relationship in silicon [Renucci et al., Phys. Rev. B 11, 3885 (1975)] concluded that it was only approximately valid. It is shown for silicon in the resonant regime that the agreement between the measured values of the Raman matrix element squared, $\sigma=|R|^2$ and

$K^2|d\epsilon/dE|^2$, is very good indeed, if accurate values of the dielectric function are used. With the use of recently obtained temperature-dependent optical functions of silicon, the absorption coefficient, the Raman matrix element squared, the index of refraction, and the normal-incidence reflectivity are determined and shown to be strong functions of temperature in the resonant regime. The Stokes to anti-Stokes intensity ratio is calculated and found to compare favorably with values found in the literature for samples held at constant temperature. It is concluded that the temperature dependence of the optical properties must be included in any interpretation of measurements to determine the temperature from the Stokes to anti-Stokes intensity ratio. (20 refs.)

120087 Theory of phonon sideband resonances in Raman scattering from semiconductors. K.P.Jain, R.Gupta, N.C.Kothari (Dept. of Phys., Indian Inst. of Technol., New Delhi, India), M.Balkanski, M.Jouanne.
Phys. Rev. B (USA), vol.28, no.6, p.3362-71 (15 Sept. 1983).
A general many-body theory of phonon sidebands (replicas) of electronic transitions in semiconductors with shallow impurities is formulated. It is found that, in addition to the usual contribution to one-phonon sideband Raman amplitude due to the ordinary electron-phonon interaction term, there is another contribution which includes the effect of interaction between band electrons and electrons localized on the impurity site. The present theory, which is consistent with scattering from phonons and electronic transitions, is used to calculate the relative Raman amplitudes of $1s \rightarrow 2s$ electronic transition between the lithium acceptor states in ZnTe:Li and its LO-phonon sideband. Good agreement with experiment is obtained for electron-phonon interaction V, about 15 meV, and electron-electron interaction, J, ranging between 20 and 30 meV. (18 refs.)

120088 Raman scattering, defect luminescence, and phonon spectra of ^{7}LiH, ^{6}LiH, and ^{7}LiD crystals. A.Anderson, F.Luty (Dept. of Phys., Univ. of Utah, Salt Lake City, UT, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3415-21 (15 Sept. 1983).
Two types of phonon spectra, obtained by Ar^+-ion-laser irradiation of lithium hydride crystals, have been observed and analyzed for the three isotopic components ^{6}LiH, ^{7}LiH, and ^{7}LiD. Two-phonon Raman spectra of pure crystals were measured at 300 and 10K. One-phonon spectra were obtained from measurements of the resolved sideband structure of a strong zero-phonon emission line around 600 nm. This emission is produced by defects of very weak electron-phonon coupling, which are present in crystals either irradiated or containing a slight nonstoichiometric excess of Li. Both Raman and luminescence spectra show in their detailed resolved structure pronounced isotope shifts allowing a classification of the phonon modes involved. Comparison with data from neutron scattering and lattice-dynamics calculations gives very close agreement and identifies the modes as originating essentially from X and L points at the Brillouin-zone edges. Isotope effects on the zero-phonon lines of the defect luminescence are also observed and discussed. (14 refs.)

120089 Infrared spectra at room and at low temperature of single crystals of 3(4-chlorophenyl)2-cyanopropenonitrile. R.Bugueno-Hoffmann, J.Meinnel (Lab. de Phys. Cristalline, CNRS, Rennes, France).
Spectrochim. Acta Part A (GB), vol.39A, no.9, p.771-5 (1983).
The oriented single crystals of 3(4-chlorophenyl)2-cyanopropenonitrile, assignments at ambient and liquid nitrogen temperature, are reported for most of the bands, observed from 4000-300 cm^{-1} in the IR spectra. It is interesting to notice that remarkable crystal field effects were pointed out in the spectra. Neither the temperature dependence in the i.r. nor the specific heat between 40-7K and differential thermal analysis between 293 and 120K revealed the existence of a transition. (10 refs.)

120090 Infrared spectral investigation of orthovanadates and CrO_6 groups in $TlM^{II}Cr_2(VO_4)_3$ compounds. M.A.Nabar, D.S.Phanasgaonkar (Dept. of Chem., Univ. of Bombay, Bombay, India).
Spectrochim. Acta Part A (GB), vol.39A, no.9, p.777-9 (1983).
The IR spectra of triple orthovanadates $TlM^{II}Cr_2(VO_4)_3$ (where M=Co, Ni, Cu, Mg, Ca, Sr, Ba or P's) have been obtained in the region 4000-200 cm^{-1} and are discussed with the aid of site group analysis. The complexity of the spectra is attributed to the possibility of VO_4^{3-} groups being located on two sites of different symmetries as well as to appearance of vibrational modes corresponding to condensed CrO_6 lattice. (14 refs.)

120091 Studies on polynuclear molybdates in the aqueous solution by laser Raman spectroscopy. K.Murata, S.Ikeda (Dept. of Chem., Osaka Univ., Osaka, Japan).
Spectrochim. Acta Part A (GB), vol.39A, no.9, p.787-94 (1983).
Polynuclear molybdates in the aqueous solution were investigated by the use of laser Raman spectroscopy. It was found from Raman measurements and chemical analysis of salts that two species of $Mo_6O_{19}^{2-}$ and $Mo_{12}O_{37}^{2-}$, except for $Mo_7O_{24}^{6-}$ and $Mo_8O_{26}^{4-}$ to be known, exist in the weakly acidic solutions. These species play an important role in the formation of heteropolymolybdate such as 12-molybdophosphate. The intensity in the Raman spectra was normalized by using an internal standard of sodium nitrate. This normalization made it possible to investigate some chemical equilibria of polynuclear species in detail. The formation constant of $Mo_7O_{24}^{6-}$ to be determined from this procedure agrees with that to be previously reported by the use of potentiometry. (29 refs.)

120092 The vibrational spectrum of anisole. W.J.Balfour (Dept. of Chem., Univ. of Victoria, Victoria, BC, Canada).
Spectrochim. Acta Part A (GB), vol.39A, no.9, p.795-800 (1983).
The infrared and Raman spectra of $C_6H_5OCD_3$, $C_6D_5OCH_3$ and $C_6D_5OCD_3$ have been recorded in the liquid state. Vibrational assignments have been made and values for most of the fundamental vibrations have been obtained and correlated with those of $C_6H_5OCH_3$. Studies of the ultraviolet absorption spectrum have provided gas-phase data on a number of totally symmetric modes. (11 refs.)

120093 Water overtone and combination bands in the near-infrared spectrum of $M_2FeCl_5.H_2O$ (M=Cs,K) at cryogenic temperatures. P.J.McCarthy (Dept. of Chem., Canisius Coll., Buffalo, NY, USA), I.M.Walker.
Spectrochim. Acta Part A (GB), vol.39A, no.9, p.827-34 (1983).
Polarised crystal spectra of $Cs_2FeCl_5.H_2O$ have been measured at 10K in the range 3900-20000 cm^{-1} (2550-500 nm). The two ligand field spectra (8000-20000 cm^{-1}) agree with those in the literature. Three distinct spectra were obtained in the 3900-7500 cm^{-1} range. The symmetry, intensity and energy of the bands permit their assignment principally as combination and overtone vibrations of the bound water. The plane of the water molecule is calculated to lie about 32° above or below the *bc* plane of the crystal. Limited assignments are offered for the more complex crystal system, $K_2FeCl_5.H_2O$. (15 refs.)

120094 Infrared and Raman spectra of trans-$[MX_2(H_2O)_4]^+$ type complex ions (M=Ti(III), V(III) and Cr(III) and X=Cl and Br). D.Michalska-Fong (Todd Wehr Chem. Building, Marquette Univ., Milwaukee, WI, USA), P.J.McCarthy, K.Nakamoto.
Spectrochim. Acta Part A (GB), vol.39A, no.9, p.835-42 (1983).
The infrared and low-temperature Raman spectra of $Cs_3VCl_6.4H_2O$, $Cs_2CrCl_5.4H_2O$, $Cs_2TiCl_5.4H_2O$, $Cs_2VBr_5.4H_2O$, and related compounds have been measured in the region from 4000 to 200 or 100 cm^{-1}. Normal coordinate calculations have been carried out on the trans-$[MCl_2(H_2O)_4]^+$ structure (M=V(III), Cr(III) and Ti(III)) derived from X-ray analyses of the first two compounds. The presence of the trans-$[MX_2(H_2O)_4]^+$ type (X=Cl and Br) ion in all the compounds studied has been confirmed by the similarity of their vibrational spectra. (16 refs.)

120095 Raman tensor of covalent semiconductors. L.Brey, C.Tejedor (Dept. de Fisica del Estado Solido, Univ. Autonoma, Madrid, Spain).
Solid State Commun. (USA), vol.48, no.4, p.403-6 (Oct. 1983).
The Raman cross section in covalent semiconductors is analysed by means of simple tight-binding models. The required dependence of the model Hamiltonian upon the ionic displacements is estimated from the variation of the electronic susceptibility of a crystal under hydrostatic pressure. The results for the Raman tensor are in satisfactory agreement with both experimental data and previous computations. Some results for the optical deformation potentials are presented as well. (21 refs.)

120096 Structure of vibrational spectra of $Cd_{1-x}Hg_xTe$ solid solutions. S.P.Kozyrev, L.K.Vodop'yanov, R.Triboulet (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.361-4 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR),* vol.25, no.3, p.635-41 (March 1983). [received: Oct. 1983]
An investigation was made of the lattice reflection spectra of $Cd_{1-x}Hg_xTe$ ($0 \leq x \leq 0.8$) solid solutions recorded in the spectral range 20-90 μm at $T=85K$. Two separate CdTe-and HgTe-like reststrahlen bands with intensities typical of two-mode systems were investigated. A fine structure was observed for compositions with $x=0.1$-0.6 in the region of the CdTe-like band. These spectral features were explained by a harmonic model postulating the dependences of the frequencies and oscillator strengths of the lattice vibrations of the composition x and allowing for the tendency of formation of clusters from cations of one kind (Cd or Hg) around Te anions. The optical vibrations were calculated allowing only for the elastic interaction between the nearest neighbors in the equations of motion; forces acting over longer distances were allowed simply by introducing an effective field. The reflection spectra calculated on the basis of this model agreed with the experimental results on the assumption that the cluster-formation parameter was sufficiently large ($\beta=0.6$). (12 refs.)

120097 Influence of an external environment on the vibrational spectra of SeO_3^{2-} and SO_3^{2-} impurity anions in KCl and KBr crystals. V.V.Boiko, I.Ya.Kushnirenko, V.I.Vaidanich (T.G. Shevchenko State Univ., Kiev, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.380-4 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR),* vol.25, no.3, p.667-74 (March 1983). [received: Oct. 1983]
An investigation was made of the structure of the infrared absorption spectra of SeO_3^{2-} and SO_3^{2-} anions formed in alkali halide (KCl and KBr) crystals in the course of additional doping with Ca^{2+} and Ba^{2+} cations. A study was made of the influence of the crystal environment and of defects (Me^{2+} cations, vacancies) in the immediate vicinity of anions on their local symmetry. A calculation was made of vibrations of anions of the C_{3v} symmetry in the case when the local symmetry was reduced to C_s. The structure of the spectra was identified, the force constants with the Se-O and S-O bonds were determined, and the changes in these constants as a result of reduction in the local symmetry of the anions were found. (13 refs.)

120098 Lattice reflection spectra of TlS_xSe_{1-x} solid solutions. R.A.Aliev, K.R.Allakhverdiev, R.M.Sardarly, N.Yu.Safarov (Inst. of Phys., Acad. of Sci., Baku, Azerbaidzhan SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.520-1 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR),* vol.25, no.3, p.904-5 (March 1983). [received: Oct. 1983]
The authors have investigated the long-wavelength infrared reflection spectra of the TlS_xSe_{1-x} solid solution system. They have found the composition dependences of the frequencies of the infrared-active phonons, and established mixed one- and two-mode dependences of the optical phonon frequencies on the composition. (6 refs.)

120099 Raman scattering and symmetry of vibrational modes in SnI_4 crystals. A.V.Bobyr', I.S.Gorban', V.A.Gubanov, G.I.Salivon, T.N.Sushkevich, V.V.Friezel'.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1327-34 (Sept. 1983). In Russian.
Vibrational frequencies of the Raman active modes of SnI_4 crystals were obtained from the polarized Raman spectrum. Group-theoretical analysis of the symmetry of the vibrational modes in the centre of the Brillouin zone was performed. A correlation diagram was constructed to demonstrate the correspondence between the vibrational modes of the crystal and modes of the SnI_4 molecule, the nature and specific features of the low-frequency spectrum have been examined. (5 refs.)

120100 Dynamic intermolecular effects in C_2Br_4 single crystal. G.E.Krasnyanskii, Yu.P.Tsyashchenko, N.E.Ralko.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1343-6 (Sept. 1983). In Russian.
A quantitative evaluation is performed for relative intensities of intramolecular vibration Davydov splitting components ν_9 and ν_{11} in the C_2Br_4 crystal infrared absorption spectrum. The comparison of these with experimental ones shows that the use of the dipole-dipole interaction potential makes it possible to give a complete quantitative description of dynamic intermolecular effects in the C_2Br_4 crystal. (6 refs.)

120101 Infrared absorption spectra of silicoantimonical cation-exchangers. B.G.Novikov, E.A.Materova, G.A.Burdakova.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.103-5 (Aug. 1983). In Russian. (12 refs.)

Electronic and infrared spectra of iodoline ....See Entry 117864

Raman spectroscopic studies on the vibrational relaxation of benzonitrile in benzene solution ....See Entry 117878

Orientation of molecules of epoxide oligomers in a uniform stationary magnetic field ....See Entry 118023

Molecular reorientation in liquid crystals ....See Entry 118871

Determination of pitch in chiral smectic C DOBAMBC ....See Entry 118886

Hydrogen bonding in segmented polyurethanes: band assignment for the carbonyl region ....See Entry 118902

Structural studies on undoped poly(acetylene) ....See Entry 118906

Synthesis and properties of $(CH)_x$-films prepared by polymerization of BTFM-TCDT ....See Entry 118911

Structure and morphology of segmented polyurethanes. I. Influence of incompatibility on hard-segment sequence length ....See Entry 118919

Structure of dense cross-linked polymers of dimethacrylates and oligo-*n*-methacrylates ....See Entry 118921

New calcium gallates of lanthanum and neodymium ....See Entry 118964

Syntheses, lattice parameters and solid state absorption spectra of the first five transplutonium orthophosphates ....See Entry 118972

Synthesis and structure of $Gd_2(CO_3)_3.nH_2O$ (n=2,3) ....See Entry 118977

Ln_2BaZnO_5 and $Ln_2BaZn_{1-x}Cu_xO_5$: A series of zinc oxides with zinc in pyramidal coordination ....See Entry 118978

Structural analysis of 3-*C*-phosphonates, -phosphinates, and -phosphine oxides of branched-chain sugars ....See Entry 118990

Dynamics and vibrational spectroscopy of doped polyacetylene as one dimensional disordered crystal ....See Entry 119140

Optically detected low temperature phase in pyrene crystals . See Entry 119175

Structural phase transition of $CsPbCl_3$ below room temperature ....See Entry 119179

Pressure-induced phase transition in β-$LiIO_3$ ....See Entry 119183

Phase transition in cadmium chlorapatite [$Cd_5(PO_4)_3Cl$] ....See Entry 119186

Hydrate to pseudohydrate transformation in $Cd(ClO_4)_2.6H_2O$: An IR study ....See Entry 119187

Study of the system $NH_4Fe(SO_4)_2$-H_2SO_4-H_2O or 25°C and the appearance of solid phases ....See Entry 119204

n-type doping of $(CH)_x$: molecular diffusion of the dopant ....See Entry 119273

Investigation of the sorption of stearic acid and its esters on steel ....See Entry 119332

Oxygen-bonding environments in glow-discharge—deposited amorphous silicon-hydrogen alloy films ....See Entry 119367

Nitrogen-bonding environments in glow-discharge-deposited *a*-Si:H films ....See Entry 119368

Bonding in hydrogenated hard carbon studied by optical spectroscopy ....See Entry 119369

Spectral studies on the electronic structure of polyacetylene . See Entry 119408

Phase transitions in TMAITCNQ by resonance Raman spectroscopy ....See Entry 119441

Erasable optical switching in semiconductor organic charge-transfer complexes ....See Entry 119445

Polyacetylene: the search for solitons ....See Entry 119554

Semiconductor to metal transition in $MoCl_5$ doped polyacetylene ....See Entry 119671

Electrical conductivity of doped polyacrylonitrile $(PAN)^+$ ....See Entry 119730

Paramagnetic resonance and optical absorption of Co^{4+} in $SrTiO_3$ ....See Entry 119905

Orientation and relaxation in uniaxially stretched atactic polystyrene ....See Entry 120020

Boron impurity anti-site defects in p-type gallium-rich gallium arsenide ....See Entry 120116

Role of molecular anions in the formation of complex centers in cesium iodide detectors ....See Entry 120117

Interaction in the K_2O-Mn_2O_3-P_2H_2O system at 140-400°C ....See Entry 120231

Soluble polyacetylene ....See Entry 120297

Cis-trans isomerization of polyacetylene ....See Entry 120611

EPR and IR investigation on cis-trans isomerization and oxidation of polyacetylene films ....See Entry 120614

Raman microprobe analysis of thin films formed on the surface of silver electrical contacts utilizing the surface-enhanced Raman scattering effect ....See Entry 120691

Use of infrared spectroscopy to identify crystalline aluminium hydroxides of the $Al(OH)_3$—$Fe(OH)_3$ system ....See Entry 120701

The infrared spectrum of hypersthene and the interstellar silicate component ....See Entry 121769

78.35 BRILLOUIN AND RAYLEIGH SCATTERING

120102 Theory of inelastic light scattering processes in $(CH)_x$. E.J.Mele (Dept. of Phys., Univ. of Pennsylvania, Philadelphia, PA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.267-72 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Outlines an analysis of the Stokes lineshape dispersion in trans$(CH)_x$ which attributes the effect to the excitation energy dependence of the relaxation pathway for the polymer following photoexcitation rather than to Raman scattering in short trans segments. (16 refs.)

120103 Dynamical light scattering. W.Przygocki (Inst. Wlokien Sztucznych, Politech. Lodzka, Lodz, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.1, p.1-3 (Jan. 1983). In Polish. [received: Oct. 1983]
The physical principles of the method of dynamical light scattering are discussed. The applications of this method to the measurement of the diffusion coefficient of macromolecules and to studies on the dynamical properties of polymers are considered. (22 refs.)

120104 The effect of a small amount of difficult-soluted impurity on light scattering by aqueous solutions of nonelectrolytes. E.P.Kulikova, M.F.Vuks, L.V.Shurupova.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.91-4 (Aug. 1983). In Russian.
The effect of a small amount of difficulty-soluble impurity (anthracene) on the intensity of light scattering in aqueous solutions of *t*-butanol, acetonitrile and dioxan has been studied. A small amount of anthracene increases the intensity of light scattering due to the desorption of anthracene microcrystals on the border of two coexisting microphases with different structure in that region of concentrations where the cooperative change of the solution structure takes place. (12 refs.)

120105 Light scattering from a Na_2O-SiO_2 glass with metastable phase separation. W.Rohmann (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.107-12 (1983). In English.
Using a particle model for diffusion-controlled growth in a metastable immiscible system proposed by Frank (1950) and Zener (1949) the parameters of scattering particles have been determined by one and two parameter fitting of the scattering curves to experimental data for a Na_2O-SiO_2 glass. It is concluded that two-parameter-fitting is a suitable method to determine particle radii and the parameter characterizing the refraction index profile. (5 refs.)

Role of cations in the conformation of iota and kappa carrageenan ....See Entry 118006

Hydrophobic interactions in dilute solutions of poly(vinyl alcohol) ....See Entry 118848

Rayleigh light scattering by liquids composed on interacting anisotropic molecules—spherical tensor approach within the second order approximation of the DID model ....See Entry 118857

Light scattering of solutions of polyamidohydrazide and conformational characteristics of its molecules ....See Entry 118861

Dynamic light scattering of surface fluctuations of a nematic liquid crystal ....See Entry 119312

Influence of structure and surface behaviour on thin film light scattering ....See Entry 120175

Comparative determination of the size of disk-shape colloid particles by conventional and electric light scattering ....See Entry 120682

78.40 VISIBLE AND ULTRAVIOLET SPECTRA

120106 Solvatochromic behaviour of ferrodiin and ferroin. C.C.Deb, D.K.Hazra (Dept. of Chem., Univ. of North Bengal, Darjeeling, India), S.C.Lahiri.
Indian J. Chem. A, vol.22A, no.3, p.234-6 (March 1983). [received: Oct. 1983]
The solvent dependence of the spectral behaviour of ferrodiin and ferroin has been examined in various solvents. The results indicate a slight solvent dependence of the charge-transfer band (ν_{max}) of $Fe(LL)_3{}^{2+}$, but it is not as pronounced as in the case of $Fe(LL)_2(CN)_2$(L-L=diamine). The behaviour of hydrogen bonding solvents is different from that of dipolar aprotic solvents. (15 refs.)

120107 Poly(2,2′-bithiophene): an electrochromic conducting polymer. M.A.Druy, R.J.Seymour (Fundamental Res. Lab., GTE Labs. Inc., Waltham, MA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.595-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors present the optical properties of poly (2,2′ bithiophene) and show that this material exhibits electrochromic behavior. (11 refs.)

120108 Doping of polyparaphenylene—a spectroscopic study of thin transparent films. B.Tieke, Ch.Bubeck, G.Lieser (Inst. fur Makromolekulare Chemie, Univ. Freiburg, Freiburg, Germany).
J. Phys. Colloq. (France), vol.44, no.C-3, p.753-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
p- and n-type doping of poly-1,4-phenylene as well as the reaction of the doped polymer with moisture were studied by absorption spectroscopy, using thin transparent films of the polymer. (13 refs.)

120109 Theoretical interpretation of the vacuum ultraviolet reflectance of liquid helium and of the absorption spectra of helium microbubbles in aluminium. A.A.Lucas, J.P.Vigneron, S.E.Donnelly (Inst. for Res. in Interface Sci., Facultes Univ. Notre-Dame, Namur, Belgium), J.C.Rife.
Phys. Rev. B (USA), vol.28, no.5, p.2485-96 (1 Sept. 1983).
The position and width of the helium resonance line $1^1S_0 \rightarrow 2^1P_1$ are calculated for a high-density helium fluid. The theory aims at understanding the reflectivity data of Surko et al. for the low-temperature liquid-vapour interface and the absorption data of Rife et al. for room-temperature, high-pressure helium bubbles in aluminium. The theoretical ingredients of the model are (i) the long-range dipole interaction of an excited 2*P* atom with the rest of the fluid and with the metal substrate; (ii) the short-range Pauli pseudorepulsion arising from othogonalisation of the 2*p*-electron wave function with the 1*s* ground-state orbital of neighbouring atoms; (iii) a statistical treatment of the high-density fluid based either on the experimentally measured radial pair distribution function of low-*T* liquid He, or on the Percus-Yevick distribution function of hard spheres and the theoretical equation of state of Young et al. for the He fluid in the bubbles; (iv) the standard static line-broadening theory to calculate the effect of Pauli repulsion on the line shapes. The theory provides a reasonably accurate understanding of the observed spectra in both the liquid and high-density gas, and can serve as a sound basis for interpretation of vacuum ultraviolet spectra in other gas-metal combinations. (37 refs.)

120110 The origin of anomalous temperature dependences of intensities of spin-forbidden d-d transitions in octahedral complexes. A.v.MalakhoVskii, G.G.Vasiljev (L.V. Kirensky Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Solid State Commun. (USA), vol.48, no.4, p.353-6 (Oct. 1983).
It is shown that anomalous temperature dependences of intensities of spin-forbidden d-d transitions, observed in octahedral magnetically-ordering complexes in a paramagnetic phase and in particular in hexagonal $RbMnCl_3$, investigated by the authors, can be accounted for by a pair-vibrational mechanism, which represents two simultaneous events: breaking of selection rules for spin during pair absorption by exchange coupled ions and breaking of those for parity during an ordinary electronic transition in one of the ions of the pair due to excitation of odd-parity vibrations. (12 refs.)

120111 Reflection spectra of $LiTaO_3$ in the fundamental absorption region. A.M.Mamedov (S.M. Kirov State Univ., Baku, Azerbaidzhan SSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.514-15 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.894-6 (March 1983). [received: Oct. 1983]
The author has used the method of vacuum ultraviolet spectroscopy to study the electron spectra of single crystals of lithium tantalate $LiTaO_3$, which is a member of a large family of oxygen-octahedral crystals. The measurements were carried out to determine the role of the TaO_6 octahedra in the electron band structure of lithium tantalate and to obtain information on the spectra

of high-energy excitations, which is still lacking in spite of extensive experimental and theoretical investigations of the electron structure of oxygen-octahedral ferroelectrics. (8 refs.)

The cholesteric pitch in lyotropic solutions of a semi-rigid macromolecule: hydroxypropyl-cellulose .... See Entry 118875

Syntheses, lattice parameters and solid state absorption spectra of the first five transplutonium orthophosphates .... See Entry 118972

Ionic and electronic processes during Frenkel defect annealing in KBr crystals above LHeT .... See Entry 119012

Carbon-related vibronic bands in electron-irradiated silicon ... See Entry 119070

Optically detected low temperature phase in pyrene crystals . See Entry 119175

The preparation and characterization of strained-layer superlattices in the GaAs+GaP system .... See Entry 119365

Bonding in hydrogenated hard carbon studied by optical spectroscopy .... See Entry 119369

Spectral studies on the electronic structure of polyacetylene . See Entry 119408

Electronic structure and optical properties of solid methane .. See Entry 119434

Theoretical and experimental investigation of the optical properties of mixed-valence compound SmB_6 .... See Entry 119436

Interpretation of the optical and magnetic behaviours of $Pr_2Mg_3(NO_3)_{12}.24H_2O$ .... See Entry 119525

'Organic metals': synthesis of new electron donors derived from bis(chalcogenopyrannylidenes) and 3:3′-bis(1,2-dithiolylidenes) .... See Entry 119572

Electrical conductivity of doped polyacrylonitrile $(PAN)^+$ ...... See Entry 119730

Paramagnetic resonance and optical absorption of Co^{4+} in $SrTiO_3$ .... See Entry 119905

Optical and ESR investigations of lanthanum aluminates $LaMg_{1-x}Mn_xAl_{11}O_{19}$ single crystals with magnetoplumbite-like structure .... See Entry 119906

High-pressure optical absorption and X-ray-diffraction studies in RbI and KI approaching the metallization transition .... See Entry 120021

Fundamental optical properties of In halides .... See Entry 120037

Extended range optical absorption spectra of electrochemically doped trans $(CH)_x$ .... See Entry 120061

Plasma reflectance of the one-dimensional organic metals of the type $(arene)_2XF_6$(arene=perylene, pyrene or fluoranthene; X=P, As, Sb) .... See Entry 120073

Determination of the nitrogen doping of liquid phase epitaxy GaP and $Ga_xIn_{1-x}P$ alloys by optical absorption and photoluminescence .... See Entry 120114

Excitation and decay of H4 luminescence in diamond .... See Entry 120132

The complexes of platinum, their optical properties and their changes in optical glasses .... See Entry 120148

Characteristics of the spectral and luminescence properties of Nd^{3+} ions in γ-La_2S_3 semiconductor single crystals .... See Entry 120150

Degradation of the electronic excitation of the $^4F_{3/2}$ state of Nd^{3+} ions in a γ-La_2S_3 single crystal .... See Entry 120151

Recent progress on LADA growth of HgCdTe and CdTe epitaxial layers .... See Entry 120244

Soluble polyacetylene .... See Entry 120297

Epoxy materials with good optical properties for applications in electron optics .... See Entry 120456

78.45 STIMULATED EMISSION

(see also 42.65C in nonlinear optics)

120112 Stimulated emissions from Er^{3+} ions at 1.7 μm in self-activated oxygen-containing Er crystals. A.A.Kaminskii, A.G.Petrosyan (A.V. Shubnikov Inst. of Crystallography, Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1645-7 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1910-11 (Nov. 1982).
The effect of SE generation by Er^{3+} ions at ~110K on the waves of the additional channel $^4S_{3/2} \to {}^4I_{9/2}$ (range ~1.7 μm) high-Er^{3+} crystals with a garnet (space group $O_h{}^{10}-Ia3d$) and perovskite ($D_{2h}{}^{16}-Pbnm$) structure whose initial state ($S_{3/2}$) is also submitted to strong concentration quenching due to cross relaxation was studied. This study is based on the results of a study of the real intensity of spectral transitions of Er^{3+} ions in fluorine and oxygen-containing crystals. (15 refs.)

120113 Gain saturation in photoexcited semiconductors. A.Ron (Dept. of Chem. & Solid State Inst., Technion, Haifa, Israel), A.Ron, E.Cohen.
Phys. Rev. B (USA), vol.28, no.6, p.3324-9 (15 Sept. 1983).
A model is presented which provides a satisfactory explanation of the spectral shape of the stimulated emission in highly photoexcited (direct-gap) semiconductors at low temperatures. The model assumes the existence of an electron-hole plasma which fills a fraction of the excited volume depending on the excitation intensity. The processes in the plasma are electron and hole generation by the external excitation, recombination by stimulated emission, and particle relaxation within the plasma by collisions. The last one is described by a cross section which depends on the particle-energy separation from the Fermi surface. The coupled rate equations for the electrons (holes) and the radiation field are solved under steady-state conditions. The calculated stimulated-emission spectra show a red shift as a function of a parameter which is proportional to the product of the excitation intensity and stripe length. The result explains well the red shift and saturation of stimulated-emission spectra observed in GaAs by Shaklee et al. (1973). (18 refs.)

Amplified spontaneous emission in doped alkali-halides .... See Entry 118150

78.50 IMPURITY AND DEFECT ABSORPTION IN SOLIDS

120114 Determination of the nitrogen doping of liquid phase epitaxy GaP and $Ga_xIn_{1-x}P$ alloys by optical absorption and photoluminescence. V.Thierry-Mieg, A.Marbeuf, J.Chevallier, H.Mariette (Lab. de Phys. des Solides, CNRS. Meudon-Bellevue, France), M.Bugajski, K.Kazmierski.
J. Appl. Phys. (USA), vol.54, no.9, p.5358-62 (Sept. 1983).
Optical absorption and photoluminescence have been used to determine the nitrogen concentration in liquid phase epitaxy GaP and $Ga_xIn_{1-x}P$ layers. Both methods give the same variation of nitrogen concentration. The same nitrogen maximum concentration of $[N]=8\times10^{17}$ cm^{-3} has been found in GaP and in $Ga_{0.998}In_{0.002}P$ grown at 900°C and $P_{NH3}>10^{-3}$ atm. In $Ga_xIn_{1-x}P$, it has been shown that the nitrogen concentration incorporated in the layer decreases as the indium amount increases, for indium concentrations less than 5%, in samples prepared with identical growth conditions. (21 refs.)

120115 Induced absorption and metastable states in ZnS:Mn and ZnS. J.M.Noras (Dept. of Phys., Univ. of Bradford, Bradford, England).
J. Phys. C (GB), vol.16, no.28, p.5517-21 (10 Oct. 1983).
The absorption and excitation spectra of a strong photoinduced band found in samples of ZnS:Mn at 6 and 77K are reported. The process involves first the population of a metastable level and subsequently excitation to a higher level, which shows the induced absorption. The centre responsible is not identified. (2 refs.)

120116 Boron impurity anti-site defects in p-type gallium-rich gallium arsenide. J.Woodhead, R.C.Newman, I.Grant, D.Rumsby, R.M.Ware (J.J. Thomson Phys. Lab., Univ. of Reading, Reading, England).
J. Phys. C (GB), vol.16, no.28, p.5523-33 (10 Oct. 1983).
It is shown that gallium arsenide crystals grown from gallium-rich melts encapsulated in boric oxide contain boron impurities, some fraction of which occupy arsenic lattice sites. In compensated material these acceptor defects are in negative charge state and give rise to infrared absorption due to localised vibrational modes (LVM) at 601 cm^{-1} ($^{11}B_{As}$) and 628 cm ^{1}($^{10}B_{As}$). The authors demonstrate for the first time that in p-type material neutral B_{As} defects are present although they give no detectable LVM absorption: their presence is revealed by tuning the position of the Fermi level, E_F, to the point where it coincides with the acceptor electronic level. This is achieved by introducing deep-hole traps by electron irradiation and then fine tuning of E_F is effected by varying the temperature of the sample. They estimate the B_{As} acceptor level to be somewhat greater than 0.2 eV above the valence band and there is a possibility that it is the previously reported level at 0.23 eV. The level at 0.077 eV is probably due to an intrinsic defect. (34 refs.)

120117 Role of molecular anions in the formation of complex centers in cesium iodide detectors. L.P.Smol'skaya, T.A.Kolesnikova.
J. Appl. Spectrosc. (USA), vol.38, no.1, p.129-32 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.150-4 (Jan. 1983).
It may be assumed that one of the reasons for the detrimental effect on the scintillation properties of detectors in the presence of oxygen-containing impurities is the formation of complexes containing activator ions and the oxygen-containing impurity ions. In the present work the authors have attempted to observe such complexes using IR spectroscopy and studied their distribution in the crystal. (16 refs.)

Ionic and electronic processes during Frenkel defect annealing in KBr crystals above LHeT .... See Entry 119012

Radiation damage and near-edge optical properties of ion-implanted gallium arsenide .... See Entry 119047

Oxygen-bonding environments in glow-discharge—deposited amorphous silicon-hydrogen alloy films .... See Entry 119367

Nitrogen-bonding environments in glow-discharge-deposited *a*-Si:H films .... See Entry 119368

Split-off narrow *d*-band states above E_F in transition-metal alloys .... See Entry 119421

Discrete intragap Pb states in $Pb_{1-x}Sr_xS$ .... See Entry 119499

Impurity-induced defect states in polyacetylene .... See Entry 119514

Paramagnetic resonance and optical absorption of Co^{4+} in $SrTiO_3$ .... See Entry 119905

Extended range optical absorption spectra of electrochemically doped trans $(CH)_x$ .... See Entry 120061

Optical properties of heavily doped polyacetylene films .... See Entry 120063

Theoretical interpretation of the vacuum ultraviolet reflectance of liquid helium and of the absorption spectra of helium microbubbles in aluminium .... See Entry 120109

Excitation and decay of H4 luminescence in diamond .... See Entry 120132

Characteristics of the spectral and luminescence properties of Nd^{3+} ions in γ-La_2S_3 semiconductor single crystals .... See Entry 120150

Degradation of the electronic excitation of the $^4F_{3/2}$ state of Nd^{3+} ions in a γ-La_2S_3 single crystal .... See Entry 120151

78.55 PHOTOLUMINESCENCE

120118 Time-resolved total internal reflection fluorescence spectroscopy of polymer films. H.Masuhara, N.Mataga (Dept. of Chem., Osaka Univ., Toyonaka, Japan), S.Tazuke, T.Murao, I.Yamazaki.
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.415-19 (23 Sept. 1983).
Using total internal reflection, the possibility of a subnanosecond fluorescence spectroscopy for elucidating photophysical and photochemical processes of polymer surface is demonstrated. The thickness which can be studied under the present experimental conditions is of the order of 0.01 μm. (9 refs.)

120119 Theory of coherence effects in time-dependent delayed fluorescence. II. Application to two- and three-dimensional crystals. A.Fort, V.Ern, V.M.Kenkre (Lab. de Spectroscopie et d'Optique du Corps Solide, Univ. Louis Pasteur, Strasbourg, France).
Chem. Phys. (Netherlands), vol.80, no.3, p.205-11 (15 Oct. 1983).
A recently developed theory of the effects of transport coherence of triplet excitons on the time dependence of delayed fluorescence in molecular crystals is applied to two- and three-dimensional crystals. Manifestations of anisotropy are studied for arbitrary coherence and it is shown that the mean-square-velocity tensor can be extracted explicitly in the coherent limit. (7 refs.)

120120 Singlet exciton migration in a random organic two-component system containing physical and chemical traps. G.Peter, B.Ries, H.Bassler (Fachbereich Phys. Chem., Philipps-Univ., Marburg, Germany).
Chem. Phys. (Netherlands), vol.80, no.3, p.289-97 (15 Oct. 1983).
Steady-state as well as time-dependent fluorescence studies have been carried out near 80K on glassy mixed layers of anthracene and phenanthrene doped with tetracene and containing incipient anthracene dimers, as physical traps. The efficiency of energy transfer from initially excited anthracene ('donor') sites to tetracene ('supertrap') has been measured as a function of donor concentration c_D. The results are interpreted in terms of a superposition of two transfer pathways: (i) Random walk of excitations across the donor ensemble to either tetracene or anthracene dimers and (ii) single step Forster transfer from the excited dimers (excimers) to tetracene. The efficiency of process (i) is in quantitive accord with the predictions of the 2D version of the Loring, Anderson and Feyer theory assuming diple-dipole coupling. (39 refs.)

120121 Fluorescence and its Nd^{3+} concentration dependence of Nd-doped SiO_2 glasses prepared by plasma torch CVD. K.Arai, H.Namikawa, K.Kumata, Y.Ishii, H.Tanaka, I.Iida (Electrotech. Lab., Ibaraki, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L397-9 (July 1983).
The time resolved fluorescence spectra and their Nd^{3+} concentration C_{Nd} dependence were observed in Nd-doped SiO_2 glasses prepared by plasma torch CVD. The $^4F_{3/2}$ radiative emissions observed consist of a fast (FDC, $\tau_m \simeq 0.35\ \mu s$) and a slow (SDC, $\tau_m \simeq 470\ \mu s$) decay component. The FDC are characterized by the intensity ratio ($^4F_{3/2}$-$^4I_{11/2}$/$^4F_{3/2}$-$^4I_{9/2}>1$), but the SDC by the inverse ratio and the spectral shifts to the longer wavelength. The SDC increases and reaches almost constant values in higher C_{Nd}. The FDC cannot be observed in very low C_{Nd} region, but increases abruptly in higher C_{Nd}. The FDC is ascribed to the Nd^{3+} in the clustering microstructure and the SDC is ascribed to the isolated Nd^{3+} in crystal field unique to unitary SiO_2 glass. (5 refs.)

120122 Study of two different deep levels in undoped LEC SI-GaAs by photoluminescence spectroscopy. T.Kikuta, K.Ishida (Optoelectronics Joint Res. Lab., Kawasaki, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L409-11 (July 1983).
Undoped LEC SI-GaAs crystals can be classified into two groups with respect to the deep PL emission band. One group dominantly exhibits emission peak energy at 0.8 eV, and the other at 0.65 eV. The profile along the growth direction and the wafer diameter for resistivity was similar to that for the 0.8 eV PL peak intensity in the 0.8 eV dominant crystals, while it was opposite to that for the 0.65 eV PL peak intensity in the 0.65 eV dominant crystals. The presence of these emission bands was found to depend on the growth conditions. Results suggest that two deep levels related to different origins are present in undoped LEC SI-GaAs. (13 refs.)

120123 Bound-exciton luminescence of Cu-doped ZnSe. S.-M.Huang (Dept. of Materials Sci., Tohoku Univ., Sendai, Japan), Y.Nozue, K.Igaki.
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L420-2 (July 1983).
As an experimental approach to clarify the correlation between doped impurity and native defects, copper was doped at a low temperature to high-purity ZnSe crystals with controlled deviation from stoichiometry by a previous heat treatment under molten Zn or saturation pressure of Se. Photoluminescence was measured and examined as a function of deviation from stoichiometry. The site selection doping of Cu was achieved by controlling native defect concentrations. I_1^{deep} lines are known to arise from acceptors of two different origins, V_{Zn} and Cu_{Zn}. (10 refs.)

120124 Photoluminescence and lattice mismatch in InGaAs/InP. T.Yagi, Y.Fujiwara, T.Nishino, Y.Hamakawa (Faculty of Engng. Sci., Osaka Univ., Osaka, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L467-9 (July 1983).
A new photoluminescence (PL) band in LPE InGaAs layers nearly lattice-matched to InP has been observed at 0.69 eV at 77K. This PL band has a strong correlation with the degree of the lattice mismatch between InGaAs and InP, and the intensity shows the minimum at the lattice mismatch of $-0.08\sim-0.07\%$. The in-depth profile of the PL intensity has been also measured, the result showing that the intensity slightly increases in the interface region of InGaAs and InP, though the PL intensity of the InGaAs edge emission is nearly constant in the InGaAs layer. These results are well explained by considering the difference of the lattice parameters of InGaAs and InP at both the LPE growth and room temperature, and might suggest the existence of some defects introduced during the epitaxial growth by the lattice mismatch between InGaAs and InP. (8 refs.)

120125 Deep-level luminescence in Ni-diffused GaAs. Y.Fujiwara, A.Kojima, T.Nishino, Y.Hamakawa (Faculty of Engng. Sci., Osaka Univ., Osaka, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L476-8 (July 1983).
The deep-level photoluminescence associated with the Ni deep acceptor has been investigated in various kinds of Ni-diffused GaAs. It has been found that the luminescence related to the Ni deep acceptor drastically changes from the surface to the deep region of Ni-diffused GaAs. In particular, the luminescence previously attributed to Ni-S pairs is strongly observed near the surface of all the GaAs samples doped with a variety of donor impurities. The in-depth profile measurements on these Ni-related luminescence intensities have revealed the builtup of S atoms in the vicinity of the surface region of Ni-diffused GaAs, which is probably due to the redistribution of the background S donors in GaAs bulk crystals during the high-temperature diffusion of Ni into GaAs. (10 refs.)

120126 Synthesis and luminescent properties of solid solutions $Tb_xCe_{1-x}BO_3$. B.F.Dzhurinskii, L.Z.Gokhman, A.V.Osiko, L.N.Zorina, N.N.Soshchin (N.S. Kurnakov Inst. of General & Inorganic Chem., Acad. of Sci., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.10, p.1494-7 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1739-43 (Oct. 1982). [received: Sept. 1983]
Solid solutions were synthesized in the system $CeBO_3$-$TbBO_3$. The luminescence spectra of Tb^{3+} in the matrix $CeBO_3$ were identified at 77 and 300K. It was shown that all lines in the visible part of the spectrum arise due to $^5D_4 \rightarrow {}^7F_J$ transitions. The most intense group of lines corresponds to the transitions $^5D_4 \rightarrow {}^7F_5$ in the region 5420 Å. The solid solution $Tb_{0.05}Ce_{0.95}BO_3$ with the highest concentration of terbium has the highest luminescence intensity. (8 refs.)

120127 Low temperature photoluminescence of *n*-type GaInAsP layers grown on InP by liquid phase epitaxy. B.Beaumont, G.Nataf, J.C.Guillaume, C.Verie (Lab. de Phys. du Solide et Energie Solaire, CNRS, Valbonne, France).
J. Appl. Phys. (USA), vol.54, no.9, p.5363-8 (Sept. 1983).
Layers of the quaternary alloy $Ga_xIn_{1-x}As_yP_{1-y}$ ($x\sim0.1$, $y\sim0.3$) were grown on InP(100) substrates by super-cooling liquid phase epitaxy. Tellurium was used for *n*-type doping in the range $8\times10^{17}-5\times10^{19}$ cm^{-3}. A good homogeneity of the composition of the layers was obtained at the surface. No microprecipitates of tellurium were detected by a scanning electron microscope. Systematic studies of luminescence at low temperature were used to characterize the samples, with a particular attention focused on the degeneracy of the conduction band. Calculations of the line shapes were performed based on a recombination mechanism involving acceptor-like states of the valence band and conduction band filling effects. Good agreement was obtained between calculated and experimental line shapes. The Fermi level in quaternary alloys is found to be lower than predicted by theoretical calculations using band structure properties developed in the past for definite III-V compounds such as GaAs and InP. It is suggested that this could be related with disorder electronic effects. (30 refs.)

120128 X-ray induced luminescence in crystalline SiO_2. P.J.Alonso, L.E.Halliburton, E.E.Kohnke, R.B.Bossoli (Dept. of Phys., Oklahoma State Univ., Stillwater, OK, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5369-75 (Sept. 1983).
The X-ray induced 'blue' emission from commercially available, high-quality synthetic quartz has been studied between 80 and 300K. Three overlapping bands, each having a different quenching temperature, have been experimentally resolved in the as-grown crystals. These bands peak at 440, 425, and 380 nm; their half-widths are 0.64, 0.75, and 0.92 eV; and they thermally quench in the 120-160, 170-210, and 220-270K regions, respectively. An intense electron irradiation at room temperature or an electrodiffusion (sweep) in a hydrogen atmosphere eliminates the band at 380 nm. The results suggest that the 380-nm band arises from recombination of an electron with a hole trapped adjacent to an alkali-compensated aluminum ion (i.e., an Al-M^+ center). The origins of the bands at 440 and 425 nm remain unknown. As an application of these results, a screening test is described which could assist quality control during selection of quartz bars for use in precision frequency control devices. (16 refs.)

120129 Amorphous properties of excimer luminescence in poly(*N*-vinylcarbazole) films. Y.Nozue, T.Hisamune, T.Goto (Dept. of Phys., Tohoku Univ., Sendai, Japan), H.Tsuruta.
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.2983-5 (Sept. 1983).
The emission properties of poly(*N*-vinylcarbazole) films have been investigated by monochromatic light excitation at 4.2K. The luminescence of the weakly bound excimer (the second excimer) shows the shift of the peak energy with varying excitation energy. This phenomenon is interpreted as due to the amorphous properties of the carbazole chromophores of the polymer. It is elucidated that the excimer is the localized exciton relaxed by the intercarbazole interaction at the excimer-forming site. (5 refs.)

120130 Relaxation of the 2s hot excitons in alkali iodides. H.Nishimura (Dept. of Appl. Phys., Osaka City Univ., Osaka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3233-43 (Sept. 1983).
In the 2s exciton absorption region, remarkable oscillation structures with the energy interval of the LO phonon have been observed in the luminescence excitation spectra. The oscillation structures for 1s free exciton luminescence, E_x luminescence and impurity luminescence are in phase with one another, and the structures for σ luminescence and π luminescence are also in phase with each other. The structure of the former group is, however, out of phase with the structure for the latter group. These two series of the oscillation structures are discussed by introducing several relaxation processes of 2s hot excitons, such as cascade relaxation, self-trapping and interband scattering, and the rates of the processes are estimated. (12 refs.)

120131 Relaxation processes of free excitons in KBr:Na. K.Toyoda, K.Nakamura, Y.Nakai (Dept. of Phys., Osaka Dental Univ., Hirakata, Osaka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3254-9 (Sept. 1983).
Excitation spectra of luminescence due to Na ions in KBr:Na crystals have been investigated in detail at LHeT by varying the Na content. Quantum efficiency of the luminescence shows a characteristic change according to whether the exciting energy is above or below the peak energy of the first exciton band (E_h- or E_l-excitation). Two different processes are suggested for the relaxation of the free exciton. Excitons created by E_l-excitation have much longer lifetime than those created by E_h-exciton. The diffusion length of the exciton produced under E_l-excitation is estimated to be nearly 17 lattice distances (110 A), while the diffusion length of the exciton produced under E_h-excitation is very small. (13 refs.)

120132 Excitation and decay of H4 luminescence in diamond. A.T.Collins (Wheatstone Lab., King's Coll., London, England), M.F.Thomaz, M.I.B.Jorge.
J. Phys. C (GB), vol.16, no.28, p.5417-25 (10 Oct. 1983).
Photoluminescence and cathodoluminescence decay time measurements have been carried out for the H4 (2.499 eV) centre in diamond. The photoluminescence decay time increases progressively from $\simeq$ 19 to 23 ns as the energy of the exciting light is increased from 2.6 to 4.0 eV, and the cathodoluminescence decay curves are non-exponential. Luminescence excitation measurements reveal a previously unreported absorption band peaking at about 3.2 eV in the ultraviolet spectral region; absorption of light in this band produces H4 luminescence. The range of decay times noted above is believed to be due, at least in part, to transitions from the higher excited levels via the 2.499 eV excited state. The decay time of 19 ± 1 ns measured with photoexcitation at 2.6 eV shows no significant variation with temperature, and this represents the most likely value of the radiative lifetime of the 2.499 eV centre. (14 refs.)

120133 Investigation of laser-induced luminescence and polarisation change in ferroelectric $AgNa(NO_2)_2$ in the time domain. H.Happ, C.Thoma (II. Phys. Inst., Univ. zu Koln, Germany).
J. Phys. C (GB), vol.16, no.28, p.5535-42 (10 Oct. 1983).
The luminescence in ferroelectric $AgNa(NO_2)_2$ induced by excitation of the lowest triplet state of the NO_2^- ions is measured in the time domain for temperatures between 3.1 and 330K including the region of the ferroelectric phase transition. From 50 to 330K the intensity decays exponentially and the time constant follows a $1/T$ law up to 280K. Between 10 and 40K the decay curve is complex. The ferroelectric phase transition at 312K is clearly exhibited in the temperature dependence of the initial intensity of luminescence and the time constant. In addition, the response of the spontaneous polarisation induced by transfer of excitation energy to the lattice is measured in the time domain. The time constant of the response shows critical slowing down at T_c. (12 refs.)

120134 Influence of the crystal structure on the luminescence properties of rare earths. G.Le Flem, C.Parent, C.Fouassier (Univ. de Bordeaux, CNRS, Talence, France).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.383-8 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
The influence of the crystal structure on the luminescence properties of rare earths can be reviewed by starting from two complementary points of view. (i) The use of rare earth ions such as Nd^3, Eu^{3+} and Gd^{3+} as local structural probes allows precise investigations of crystal structures to be performed. Recent results concerning the appearance of multisites in complex systems such as stabilized zirconia or sodium rare earth orthophosphates are discussed. (ii) Typical luminescence properties can be deduced directly from the crystal structure. Clear correlations have been established for families of materials with specific applications, e.g. low self-concentration quenching in neodymium microlasers, requirements for a 4f-4f Eu^{2+} emission and efficiency of Ce^{3+}-Tb^{3+} transfer. (13 refs.)

120135 Luminescence of high pressure phases of Eu^{2+}-activated alkaline earth borates and silicates. G.Y.Adachi, K.-I.Machida, J.Shiokawa (Dept. of Appl. Chem., Osaka Univ., Osaka, Japan).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.389-98 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
High pressure phases of EuB_2O_4, MB_2O_4-Eu^{2+} ($M \equiv Ca,Sr$), $EuSiO_3$ and $MSiO_3$-Eu^{2+} were synthesized at pressures of 30-150 kbar. The pressure-temperature phase diagram of EuB_2O_4 consists of the following four regions: phases I, III and IV, and a region of phase separation into EuB_4O_7 and $Eu_2B_2O_5$. The band emissions of the high pressure of EuB_2O_4 and SrB_2O_4-Eu^{2+} are assigned to $(4f)^7$-$(4f)^6(5d)$ transitions of the Eu^{2+} is about 100 times higher than that of phase I of the corresponding borate. This is firstly due to the fact that the Eu^{2+} ions in phase IV are effectively surrounded by BO_4 tetrahedra of the three-dimensional B_3O_6 network such that their interaction with neighbouring Eu^{2+} ions is restricted. Secondly, the phase transformation appears to reduce the lattice vibration of the borate network, thus decreasing non-radiative processes. The application of pressures of up to 150 kbar on $EuSiO_3$ resulted in the formation of the new high pressure phases δ and δ'. The emission intensities of $CaSiO_3$-Eu^{2+} and $SrSiO_3$-Eu^{2+} also increased appreciably (by a factor of 20-40) when the host lattices transformed into δ-$CaSiO_3$ and δ'-$SrSiO_3$. (28 refs.)

120136 Spectral properties of liquid polar solutions under conditions of dynamic inhomogeneous orientational broadening. A.N.Rubinov, V.I.Tomin.
J. Appl. Spectrosc. (USA), vol.38, no.1, p.33-50 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.42-61 (Jan. 1983). (27 refs.)

120137 Form of the fluctuation distribution function of fluorescent molecules over electron transition frequencies. E.S.Voropai, V.A.Saechnikov, A.M.Sarzhevskii.
J. Appl. Spectrosc. (USA), vol.38, no.1, p.118-23 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.138-44 (Jan. 1983).
An attempt is made to determine criteria which permit drawing some conclusions about the form of the distribution function of molecules in a rigid solution with respect to the 0-0 transition frequency on the results of spectra measurements. (21 refs.)

120138 Transient photoluminescence in cis-polyacetylene. G.Fasol (Max-Planck-Inst. fur Festkorperforschung, Stuttgart-Busnau, Germany), R.H.Friend.
J. Phys. Colloq. (France), vol.44, no.C-3, p.341-3 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors have observed photoluminescence from cis-polyacetylene prepared by the Luttinger route. They report a similar spectrum to that previously observed for Shirakawa material, with a broad photoluminescence band centred at 1.9 eV with superimposed structure attributed to resonance Raman scattering. The lifetime of the luminescence is less than the measurement system response time of 5 ns. (10 refs.)

120139 Anisotropic ligand polarization contributions to the Laporte-forbidden transition probabilities of open-shell metal complexes. B.Stewart (Dept. of Chem., Univ. of Glasgow, Glasgow, Scotland).
Mol. Phys. (GB), vol.50, no.1, p.161-71 (Sept. 1983).
The inclusion of ligand polarizability components making up the symmetric anisotropy tensor $\alpha^{(2)}$ in the ligand polarization analysis of the d-d or f-f transition probabilities of open-shell metal coordination compounds is found to account for the known cases where the corresponding mean polarizability approximation fails. For a given point group symmetry of the metal complex, the addition of the ligand polarizability anisotropy to the dynamic coupling treatment generates the number of intensity parameters required group theoretically for a given multipole transition of the metal ion. (33 refs.)

120140 Direct luminescence evidence for the degenerate electron-hole plasma formation in $A^{II}B^{VI}$ semiconductors. M.S.Brodin, V.M.Bandura, M.G.Matsko (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Status Solidi b (Germany), vol.119, no.1, p.83-7 (1 Sept. 1983).
The emission spectra of ZnTe and ZnSe crystals are investigated at $T=4.2K$ at high excitation densities by a Coumarin 30 and 120 dye laser. It is shown that for excitation densities $R_{exc}>0.1$ MW/cm^2 the emission spectrum of ZnTe exhibits the P-band due to inelastic exciton-exciton scattering. For $R_{exc}>6$ MW/cm^2 the emission of a degenerate electron-hole plasma (EHP) is observed. These emission bands may be differentiated by scanning the exciting quanta energy in the short-wavelength tail region. (11 refs.)

120141 Photoluminescence decay in amorphous silicon alloys. B.Rauscher (Forschungslab. Siemens AG, Munchen, Germany), B.Bullemer.
Phys. Status Solidi a (Germany), vol.79, no.1, p.161-6 (Sept. 1983).
The photoluminescence (PL) decay of undoped a-Si:H, a-Si:O, H, and a-Si:C, H alloys during the first microsecond after excitation is investigated. In all alloys the fastest decay is observed for the short-wavelength PL photons, this is attributed to charge carriers trapped in shallow localized states tunneling to deeper states. This tunneling process competes with the radiative recombination. The nonradiative recombination at nonzero temperatures is interpreted as a thermal activation of the trapped charge carriers to the mobility edges followed by diffusion to nonradiative recombination centres. Whereas the initial decay is thereby accelerated, the radiative decay time in the long-term decay is observed to be prolonged if the temperature rises from 30 to 75K. (13 refs.)

120142 Dependence of photoluminescence on temperature in dislocated silicon crystals. M.Suezawa, Y.Sasaki, K.Sumino (Res. Inst. for Iron, Steel, & Other Metals, Tohoku Univ., Sendai, Japan).
Phys. Status Solidi a (Germany), vol.79, no.1, p.173-81 (Sept. 1983).
The intensities of photoluminescence lines D1 through D4 and also of the background component that are characteristic in a dislocated silicon crystal are measured as a function of the temperature. All of them become weaker as the temperature is raised. Such behaviour is interpreted in a quantitive way with the model in which two different kinds of traps, one with a shallow level and the other with a deep level, participate in the radiative recombination process giving rise to each photoluminescence line. The shallower levels are designed to the levels associated with hole traps that are drawn from the valence band by the deformation potential of a dislocation, and are in the range 4 to 12 meV above the top of the valence band. The deeper levels are proposed to be associated with electron traps due to the antibonding states of reconstructed bonds at the dislocation core, being located in the range 0.16 to 0.35 eV below the bottom of the conduction band. (17 refs.)

120143 The effect of low oxygen concentrations on the photoluminescence of vitreous selenium. B.T.Kolomiets, T.N.Mamontova, A.V.Chernyshov (A.F. Ioffe Phys. Tech. Inst., Acad. of Sci., Leningrad, USSR), G.Z.Vinogradova, N.V.Demokritova.
Phys. Status Solidi a (Germany), vol.79, no.1, p.K89-92 (Sept. 1983).
Considering that the disagreement between previous data and their interpretation could be due to differences in the concentration of impurities present, in particular of oxygen, the authors have undertaken a study of photoluminescence (PL) in g-Se samples containing an exactly known amount of oxygen. The oxygen content in selenium was determined from the variation of the SeO_2 absorption band intensity at 930 cm^{-1}. (6 refs.)

120144 Energy transfer and luminescence in $RbMn_xMg_{1-x}F_3$. J.Danko, D.Pacheco, B.DiBartolo (Dept. of Phys., Boston Coll., Chestnut Hill, MA, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2382-8 (1 Sept. 1983).
An investigation, directed toward an understanding of the concentration-dependent characteristics of Mn-Mn energy transfer has been carried out in $RbMn_xMg_{1-x}F_3$ via a detailed luminescence study from 4 to 120K. The emission of $RbMn_xMg_{1-x}F_3$ down to a 40 at.% Mn^{2+} concentration consists of two distinct Mn^{2+} bands which are featureless except in the case of the stoichiometric system. The bands are attributed to two localised traps positioned below the lowest excited level of Mn^{2+}. The variation of the spectra and of the decay patterns with temperature indicate a 'boil-off' mode of decay for the shallower trap and nonradiative decay to the ground state for the deeper trap. The details of the kinetics have allowed the authors to calculate the rate of energy transfer to the shallower luminescence trap for the various samples. It can be concluded that an efficient non-diffusion-limited transfer of excitation exists in $RbMn_xMg_{1-x}F_3$ down to at least 40 at.% Mn^{2+} concentration. Indirect trap-to-trap transfer, present in $RbMnF_3$, is not probable in the nonstoichiometric samples due to the increased presence of quenching sites. (15 refs.)

120145 The lifetime of the fluorescent excited state of liquid cyclohexane. L.H.Luthjens, M.P.De Haas, H.C.De Leng, A.Hummel (Interuniv. Reactor Inst., Delft, Netherlands), G.Beck.
Radiat. Phys. & Chem. (GB), vol.19, no.2, p.121-3 (1982). [received: Oct. 1983]
The average lifetime of the fluorescence of liquid cyclohexane was determined by means of pulse radiolysis with a time resolution of *ca.* 100 ps and found to be 0.95 ns. (12 refs.)

120146 Magnon fluorescence of Eu-chalcogenides stimulated by intense laser radiation. O.A.C.Nunes (Dept. de Fisica, Univ. de Brasilia, Brasilia, Brazil).
Solid State Commun. (USA), vol.48, no.2, p.159-63 (Oct. 1983).
The excitation of magnons induced by intense laser radiation in the electron subsystem of Eu-chalcogenides (magnon fluorescence) is considered. The kinetic equation for the magnon population is obtained from which the magnon excitation rate is calculated. It is found that under certain conditions the excitation rate may become greater than the magnon relaxation rate and the magnon system may reach instability. (15 refs.)

120147 Luminescence and magnetic resonance in post-hydrogenated microcrystalline silicon. F.Boulitrop, A.Chenevas-Paule (CENG, Grenoble, France), D.J.Dunstan.
Solid State Commun. (USA), vol.48, no.2, p.181-4 (Oct. 1983).
The authors report photoluminescence, EPR and ODMR studies of plasma hydrogenated LPCVD microcrystalline silicon thin films. Apart from the dangling bond EPR resonance which is similar to that observed in *a*-Si:H, and possibly the emission at 1.3 eV, they find emission bands and resonance signals quite unlike those observed in normal *c*-Si and *a*-Si:H. They conclude that *μc*-Si:H cannot be regarded purely as crystallites of pure silicon embedded in a matrix of *a*-Si:H. (11 refs.)

120148 The complexes of platinum, their optical properties and their changes in optical glasses. S.Gebala (Inst. Fizyki Politech. Wroclawskiej, Wroclaw, Poland), J.Sarzynski.
Szklo & Ceram. (Poland), vol.34, no.1, p.10-12 (Jan.-Feb. 1983). In Polish. [received: Oct. 1983]
The light transmission and luminescence is compared in the glasses which were melted in ceramic crucibles and in those remelted in the platinum crucibles. In the latter group of glasses the red and yellow luminescence is ascribed to the Pt^{2+} and Pt^{4+} complexes, the excitation spectrum and the absorption bands of which are in the range of 300 to 500 nm. Also the occurrence of Pt^0 has been observed in the absorption bands. The thermal treatment may, apparently, cause the reduction $Pt^{4+} \rightarrow Pt^{2+} \rightarrow Pt^0$. (7 refs.)

120149 Luminescence of oxygen in alkali halide crystals containing mercury-like activators. V.V.Pologrudov, E.N.Karnaukhov, A.G.Shneider (Sci.-Res. Inst. of Appl. Phys., A.A. Zhdanov State Univ., Irkutsk, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.365-7 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.642-6 (March 1983). [received: Oct. 1983]
Luminescence untypical of metal impurities or of O_2^- centers was observed on optical excitation of KCl, KBr, and KI crystals containing oxygen in the form of O_2^- and either Tl^+ or Pb^{2+} ions. A study was made of the excitation and luminescence spectra, of the temperature dependences of the luminescence and electrical conductivity, and of the luminescence decay kinetics. The results were analyzed within the framework of a model allowing for the fact that excitation creates a one-electron chemical bond between an absorbing O_2^- ion and a spatially separated electron activator trap. The bond is formed by an optical electron. (7 refs.)

120150 Characteristics of the spectral and luminescence properties of Nd^{3+} ions in γ-La_2S_3 semiconductor single crystals. A.A.Kamarzin, A.A.Mamedov, V.A.Smirnov, V.V.Sokolov, I.A.Shcherbakov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.328-31 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.557-62 (March 1983). [received: Oct. 1983]
Radiative transitions from states located above the $^4F_{3/2}$ metastable state were observed in a γ-La_2S_3:Nd^{3+} semiconductor single crystal. An analysis of the temperature dependences of the radiation spectra using time resolution spectroscopy, an analysis of the excited-state decay curves, and a comparison of the emission and absorption spectra were used to identify the intermultiplet transitions observed in the emission spectrum. It was found that neodymium ions could be excited in the fundamental absorption band of the host. (10 refs.)

120151 Degradation of the electronic excitation of the $^4F_{3/2}$ state of Nd^{3+} ions in a γ-La_2S_3 single crystal. A.Kamarzin, A.A.Mamedov, V.A.Smirnov, V.V.Sokolov, I.A.Shcherbakov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.336-9 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.569-73 (March 1983). [received: Oct. 1983]
An investigation is made of processes of population and relaxation of the $^4F_{3/2}$ neodymium upper active level in a γ-La_2S_3 semiconductor single crystal and the energy transfer microparameters are determined. Nonradiative transfer of energy from a continuous set of traps to the $^4F_{3/2}$ upper active level of neodymium was observed when the sample was excited with $\lambda=0.53$ μ radiation and cross relaxation from excited states located above the $^4F_{3/2}$ upper active level was identified. (11 refs.)

120152 The effect of rare-earth admixture on GaSe crystals radiation in the indirect transition. O.V.Fialkovskaya, P.A.Skubenko, Yu.P.Gnatenko, Z.D.Kovalyuk.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1351-4 (Sept. 1983). In Russian.
Polarization and temperature dependences of the luminescence spectra are investigated for rare-earth doped GaSe single crystals. It is shown that the use of Nd and Gd dopants in 0.01-0.1 wt.% concentrations considerably enhances the intensity of the luminescence 2.061 eV energy band. This is explained by emission of indirect bound excitons. The localization of indirect excitons is assumed to be due to localized lattice deformation arising from doping. (6 refs.)

120153 Characterisation of silicon crystals by means of photoluminescence measurements. W.Ziegler, R.Nebelung, N.Stein, H.Roppischer, F.Dybowski, S.Heide.
Wiss. Z. Tech. Hochsch. Ilmenau (Germany), vol.29, no.3, p.153-63 (1983). In German.
Methods for obtaining photoluminescence spectra over the excitation range 0.75 eV to 1.2 eV are shown for arsenic-implanted silicon, both before and after laser-annealing. Lateral variation of luminescence at two wavelengths is also shown for P+ implantation, and the effect of anodic oxidation is indicated. Finally, luminescence measurements were made on a sample which was progressively sectioned to a depth of 500 nanometers. Measurements at 4.2K, 77K and 300K are recommended. (10 refs.) *G.M.E.*

120154 Fluorescence spectra and crystal field analysis of rare earth oxyhalides and oxysulfates doped with trivalent europium and terbium. J.Holsa.
Helsinki Univ. Technol., Espoo, Finland thesis, 1983. Espoo, Finland: Helsinki Univ. Technol. (1983), 58 pp.
A crystal field (c.f.) analysis of Eu^{3+} doped RE oxyhalides, REOX:Eu^{3+}, (RE=Y, La and Gd; X=Cl, Br and I) and Tb^{3+} doped RE oxychlorides, REOCl:Tb^{3+} (RE=Y, La, and Gd), was conducted on the grounds of the corresponding fluorescence spectra. The sets of c.f. parameters calculated on the basis set of 49 $^7F_{JM}$ levels reproduce the experimental energy level schemes within rms deviations of 4-8 cm^{-1}. The strength of the crystal field decreases with decreasing ionic size of the host cation and with increasing ionic size of the host anion. Similar results were obtained for the REOCl:Tb^{3+} series. The evolution of the c.f. parameter values from REOCl:Eu^{3+} to REOCl:Tb^{3+} is in agreement with the results of an electrostatic point charge calculation and may thus be used to predict the c.f. effect in other RE^{3+} ions in REOCl. The calculation of individual parameter values by this model was not possible because of strong 'covalency' effects in RE oxyhalides. The Racah parameters and the spin-orbit coupling constant were calculated from the REOCl:Eu^{3+} and REOBr:Eu^{3+} excitation spectra. (82 refs.)

Cryostat for testing luminescence and radiation absorption in ionic crystals ....See Entry 117185

Use of photoprotolytic reaction for extending the tuning range of the emission wavelength of a 3-methoxybenzanthrone laser ....See Entry 118137

Amplified spontaneous emission in doped alkali-halides ....See Entry 118150

The temperature dependence of coherent two-photon processes in naphthalene in the strong exciton-photon coupling regime ....See Entry 118206

Strengthening of GaAs by impurity atom-vacancy complexes ....See Entry 119054

Optically detected low temperature phase in pyrene crystals . See Entry 119175

Growth and photoluminescence spectra of high-purity liquid phase epitaxial $In_{0.53}Ga_{0.47}As$ ....See Entry 119363

Residual shallow acceptors in GaAs layers grown by metal-organic vapor phase epitaxy ....See Entry 119364

The preparation and characterization of strained-layer superlattices in the GaAs+GaP system ....See Entry 119365

Strain confinement and thermodynamics of free excitons in a direct-gap semiconductor ....See Entry 119463

Investigation of the structure of many-particle exciton-impurity complexes bound to phosphorus atoms in silicon ....See Entry 119465

Time resolved observation of geminate recombination in metal-free phthalocyanine ....See Entry 119623

Optical and ESR investigations of lanthanum aluminates $LaMg_{1-x}Mn_xAl_{11}O_{19}$ single crystals with magnetoplumbite-like structure ....See Entry 119906

Identification of residual donors in high-purity epitaxial GaAs with the use of magneto-optical spectroscopy ....See Entry 120035

Raman scattering, defect luminescence, and phonon spectra of ^{7}LiH, ^{6}LiH, and ^{7}LiD crystals ....See Entry 120088

Determination of the nitrogen doping of liquid phase epitaxy GaP and $Ga_xIn_{1-x}P$ alloys by optical absorption and photoluminescence ....See Entry 120114

Radiative recombination with the participation of isoelectronic traps in solid solutions $In_{1-x}Ga_xP_{1-z}As_z$ doped with bismuth ....See Entry 120155

Vapour phase growth of arsenic chalcogenide crystals and their characterization ....See Entry 120230

Recent progress on LADA growth of HgCdTe and CdTe epitaxial layers ....See Entry 120244

Phosphorence and state of chlorophyll in solutions ....See Entry 120658

78.60 OTHER LUMINESCENCE SPECTRA AND RADIATIVE RECOMBINATION

(for photoconduction and photovoltaic effects, see 72.40; for photoluminescence, see 78.55)

Fading statistics of C-band satellite signal during solar maximum years (1978-1980) ....See Entry 121455

78.60F Electroluminescence

P_{Ga} antisite defect in Zn-implanted $GaAs_{0.1}P_{0.9}$ LED ....See Entry 119016

78.60H Cathodoluminescence, ionoluminescence

120155 Radiative recombination with the participation of isoelectronic traps in solid solutions $In_{1-x}Ga_xP_{1-z}As_z$ doped with bismuth. O.N.Ermakov.
J. Appl. Spectrosc. (USA), vol.38, no.1, p.133-7 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.155-60 (Jan. 1983).
Photoluminescence and cathodoluminescence were used to investigate the radiative recombination properties of $In_{1-x}Ga_xP_{1-z}As_z$:Bi solid solutions as a function of composition. The role of Bi impurity and isoelectronic centres is discussed. (15 refs.)

120156 Analysis and classification of layer-by-layer heterogeneities of microstructures. A.I.Drobyshev, I.V.Ogurtsova, Turkin Yu.I..
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.107-9 (Aug. 1983). In Russian.
Possible classification of layer-by-layer heterogeneities of microstructures using dispersive analysis is considered. Layer-by-layer analysis of monocrystalline plates of gadolinium-gallium garnet is carried out by means of emission spectroscopy with a hollow cathode discharge. Experimental results reveal three types of layer-by-layer heterogeneity in the objects analysed. (3 refs.)

Excitation and decay of H4 luminescence in diamond ....See Entry 120132

Micro-scaled spectral-resolved cathodoluminescence of grains in barium titanate ceramics ....See Entry 120457

78.60K Thermoluminescence

120157 Effect of γ-irradiation on the thermoluminescence of phosphorescent zinc sulphide. J.K.Zope (Dept. of Phys., Shivaji Univ., Kolhapur, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.816-17 (Oct. 1982). [received: April 1983]
Thermoluminescence (TL) measurements are made on γ-ray irradiated and unirradiated zinc sulphide powder samples. Phosphorescent zinc sulphide powder was irradiated by ^{60}Co γ-ray source of 1.55 MeV strength, for a period of 2 and 3 hr respectively. It is observed that the (TL) glow peak maximum shifts to lower temperature for the irradiated samples. The density of carriers is calculated for the irradiated and unirradiated samples. Applying Beaven's approach, the order of kinetics is determined. An analysis of the glow curves shows that the order of kinetics remains the same though the density of carriers increases in the irradiated samples. (9 refs.)

120158 Optical absorption and thermoluminescence of bismuth-doped NaCl single crystals irradiated with X-rays. M.R.Sen, A.V.K.Rao, K.V.Rao (Dept. of Phys., Indian Inst. of Technol., Kharagpur, India).
J. Mater. Sci. (GB), vol.18, no.10, p.3072-8 (Oct. 1983).
The optical absorption in the wavelength range 200 to 800 nm of Bi-doped NaCl single crystals (0.08 and 1.3 mol.%) before and after X-ray irradiation for different times, has been measured. The partial thermal bleaching characteristics of NaCl:Bi (1.3 mol.%) irradiated for one hour have been studied. The thermoluminescence (TL) curves of the doped samples irradiated for one hour have been recorded. These measurements indicate conversion of Bi^{3+} to Bi^{2+} in the doped samples with X-ray irradiation; however, when NaCl:Bi (1.3 mol.%) is X-ray irradiated for larger times than one hour, Bi^+ and Bi^0 seem to be formed also. (11 refs.)

120159 Trapping parameters for peak XII in LiF TLD-100. S.P.Kathuria (Health Phys. Div., Bhabha Atomic Res. Centre, Bombay, India), S.V.Moharil.
J. Phys. D (GB), vol.16, no.10, p.2011-16 (14 Oct. 1983).
Isothermal decay of TL peak XII recorded at five different temperatures, viz. 680, 693, 701, 711 and 719K, is shown to be non-exponential. The data when fitted into the May and Partridge equation yield the order of kinetics value between 1.3 and 1.4. Activation energy E and frequency factor s are determined independent of each other from isothermal decay data using a recently suggested method. Also the trapping parameters E and s are determined using a new method based on the fundamental TL equations of Antonov-Romanovski. The values obtained by the two methods are 1.83 eV and 1.76 eV for E and 2.8×10^{11} s^{-1} and 2.1×10^{11} s^{-1} for s respectively and these are in good agreement with each other. (9 refs.)

120160 Trapping parameters for non-saturation doses. S.V.Moharil (Dept. of Phys., Nagpur Univ., Nagpur, India), S.P.Kathuria.
J. Phys. D (GB), vol.16, no.10, p.2017-21 (14 Oct. 1983).
In recent papers the authors (see ibid., vol.16, p.425, 1983) have described methods for obtaining trapping parameters from thermoluminescence curves. The methods are applicable when the traps are filled to saturation concentration. Here, the problem of obtaining trapping parameters from TL curves recorded under non-saturation conditions is discussed. (11 refs.)

120161 Effect of post-irradiation deformation on thermoluminescence spectra of KCl:Ca and NaCl:Ca crystals. J.Manam (Dept. of Phys., Indian Inst. of Technol., Kharagpur, India), R.K.Gartia, V.V.Ratnam.
Phys. Status Solidi a (Germany), vol.79, no.1, p.167-71 (Sept. 1983).
The effect of post-irradiation deformation on the thermoluminescence spectra of KCl:Ca and NaCl:Ca crystals is studied. Deformation does not cause any appreciable change in the recombination mechanisms and sites as revealed by the occurrence of the peaks in TL emission in the same spectral regions. The deformation causes only a preferential redistribution of the traps as revealed by the changes in the relative intensities of the emissions occurring in almost the same regions. The results in KCl:Ca are in conformity with observations of Arsenovici and Townsend (1972) on the redistribution of F-centres by F-light bleaching, whereas in NaCl:Ca they are in disagreement. (9 refs.)

120162 Thermoluminescence of thallium-doped BaFCl. K.Somaih (Dept. of Phys., Post-Graduate Coll. of Sci., Osmania Univ., Saifabad, India), V.Hari Babu.
Phys. Status Solidi a (Germany), vol.79, no.1, p.237-42 (Sept. 1983).
The effect of doping of Tl upon thermoluminescence, its emission and optical absorption in flux grown BaFCl crystals is investigated. Besides an increase in luminescence output, X/γ-irradiations of BaFCl:Tl crystals produce three

additional glow peaks at 450, 465, and 500K and a TL emission spectrum at 460 nm. Optical absorption studies reveal two small bands at 340 and 650 nm. Room temperature annealing studies indicate that the three glow peaks at 450, 465, 500K and the optical absorption band at 650 nm are more stable than others present in undoped crystals. Thus the additional glow peaks are attributed to the detrapping of electrons from the substantial number of metastable energy levels as populated by the thallium impurity and subsequent radiative recombination with holes. The trap depth and frequency factor are calculated employing various methods. (12 refs.)

120163 Analysis of thermoluminescence data dominated by second-order kinetics. R.Chen, D.J.Huntley, G.W.Berger (Dept. of Phys., Simon Fraser Univ., Burnaby, British Columbia, Canada).
Phys. Status Solidi a (Germany), vol.79, no.1, p.251-61 (Sept. 1983).
In the analysis of the thermoluminescence glow curves, and in particular when applied to TL dosimetry and TL dating of archaeological and geological samples, a first order behaviour of the peaks involved is usually implicitly assumed. In this work the TL response for second order kinetics is described and shown that the usual analysis, in which a linear growth of TL with excitation dose is assumed, is correct to a good approximation provided that the curves are first shifted in temperature so that their peaks coincide. This is true for a single isolated peak and for a series of overlapping peaks. (26 refs.)

120164 Fractional order of kinetics and its variation with trap occupancy in LiF TLD-100. S.P.Kathuria, C.M.Sunta (Health Phys. Div., Bhabha Atomic Res. Centre, Bombay, India).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K77-80 (Sept. 1983).
Moharil (1981) has used the authors' data to recompute the TL (thermoluminescence) parameters. Based on his computations he agreed with the fractional order but contradicted the conclusion that the numerical value of the order of kinetics changes with trap occupancy, until the intensity of the glow peak has fallen to less than 20% of its saturated value at 165°C. The authors point out the errors in Moharil's treatment which led him to the paradoxical result like negative value of activation energy and thereby to contradict their conclusion. (7 refs.)

120165 Reply to 'Fractional order of kinetics and its variation with trap occupancy in LiF TLD-100' by S.P. Kathuria and C.M. Sunta. S.V.Moharil (Dept. of Phys., Nagpur Univ., Nagpur, India).
Phys. Status Solidi a (Germany), vol.79, no.1, p.K81-4 (Sept. 1983).
For comment see ibid., vol.79, p.K77 (1983). Kathuria and Sunta concluded from the isothermal decay of peak V of LiF TLD-100 that when traps are filled to saturation concentration, the order of kinetics (b) varied from 1 to 1.6 for decay times up to 3 min. A steady value (1.6) is obtained thereafter. This variation was not apparent in the glow curve, when Chen's method was used for calculating the trapping parameters. The reason given was that a sufficient number of traps were emptied and a constant b value was attained before any of the temperatures T_1, T_m, or T_2 could be reached. (4 refs.)

120166 Trap-level spectroscopy using the 'nonequilibrium-phase-transition model' of thermally stimulated luminescence. A.G.I.Dalvi, M.D.Sastry, B.D.Joshi (Radiochem. Div., Bhabha Atomic Res. Centre, Bombay, India).
Phys. Rev. B (USA), vol.28, no.5, p.2441-6 (1 Sept. 1983).
By considering thermally-stimulated-luminescence (TSL) phenomena as analogous to a nonequilibrium phase transition, it is shown that TSL obeying both first- and second-order kinetics can be uniquely characterised by the transition temperature T_c which is identified as the temperature at which the rate of decay of luminescence is maximum under near-isothermal conditions. The trap depth E, the frequency factor (for $T \ll T_c$) s_0, and T_c are shown to be related by the equation $2\exp(E/kT_c)=s_0(\tau/\xi)$ (where τ is the characteristic electron-hole recombination time and ξ a constant of proportionality associated with electron-hole recombination kinetics). (24 refs.)

120167 The field fluctuational model of thermally stimulated processes in ferroelectric $LiNbO_3$. I.Tale, T.Tale (Inst. for Solid State Phys., Latvian State Univ., Riga, Latvian SSR), J.Rosa.
Solid State Commun. (USA), vol.48, no.2, p.135-7 (Oct. 1983).
The thermally stimulated processes in the *X*-irradiated $LiNbO_3$ crystals were studied by the fractional glow technique. The trap ionization with unusually high values of the mean activation energy and the effective frequency factor as well as decreasing the activation energy of the traps when the temperature increased from 150-180K were observed. The authors suggest that all these effects are due to the ion-fluctuation process (the electric field generated by thermal reorientation of dipoles). (9 refs.)

Phase transitions and thermoluminescence of a plasma-sprayed zinc silicate phosphor .... See Entry 120326

Progress of thermoluminescence research on geological materials .... See Entry 121228

78.60M Sonoluminescence, triboluminescence

120168 Triboluminescence of fluorites. G.N.Chapman (Phys. Dept., Open Univ., Milton Keynes, England), A.J.Walton.
J. Phys. C (GB), vol.16, no.28, p.5543-51 (10 Oct. 1983).
The room-temperature triboluminescent spectra of single crystals of CaF_2:1% Tb, CaF_2:1% Dy, CaF_2:1% Sm and CaF_2:1% Eu have been recorded using a high-gain image intensifier spectrograph. The spectra, obtained as the crystals were cut with a diamond-impregnated circular saw, show significantly more structure than that recorded in the room-temperature photoluminescent spectra. In fact the triboluminescent spectra show structure comparable with that seen in liquid-nitrogen-temperature photoluminescent spectra. Although the details of the excitation mechanism remain obscure, the triboluminescent spectra undoubtedly arise from the rare-earth dopants. It is suggested that the observed splitting of the lines attributable to the triply ionised rare-earth dopants is due to the rapidly changing crystal fields within the vicinity of a growing crack. Spectral measurements made on a natural fluorite mineral show that part, but not all, of the triboluminescent emission produced on cutting an irradiated sample may have a thermoluminescent origin. (25 refs.)

120169 Pressure and temperature dependence of the mechanoluminescence of γ-irradiated alkali halide crystals. B.P.Chandra, M.Elyas, B.Majumdar (Dept. of Phys., Government Sci. Coll., Raipur, India).
Phys. Status Solidi a (Germany), vol.79, no.1, p.95-102 (Sept. 1983).
The intensity of mechanoluminescence (ML) produced during application and release of uniaxial pressure, in γ-irradiated KBr, KCl, KI, LiF, and NaCl crystals decreases with the number of applications and releases of the pressure. The ML intensity of γ-irradiated KBr, KCl, LiF, and NaCl crystals increases with the temperature; however, the ML intensity of γ-irradiated KI crystals decreases with the temperature. The ratio of the ML intensity during the release of the pressure to the ML intensity during the corresponding number of applications of the pressure, decreases with the temperature of the crystals. Assuming that the movement of dislocations is responsible for the ML excitation, the pressure and temperature dependence of the ML is discussed. The activation energy related to the increase in the number of dislocations with the temperature is estimated from the ML measurement and it is found to be 0.24, 0.25, 0.24, and 0.32 eV for γ-irradiated KBr, KCl, LiF, and NaCl crystals respectively. (14 refs.)

78.65 OPTICAL PROPERTIES OF THIN FILMS

120170 Electroreflectance and crystal structure of thin zinc sulfide films. J.A.Lahtinen, T.Tuomi.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.97-102 (1983).
Electroreflectance spectra of polycrystalline ZnS:Mn thin films grown by atomic layer epitaxy and electron beam evaporation techniques for electroluminescent devices are measured in the photon energy range from 3.0 eV to 4.5 eV. From the E_0 direct electron transition peaks observed at 3.74 eV and 3.71 eV it is concluded that the crystal structure of the ZnS thin films grown by atomic layer epitaxy is almost hexagonal 2 H whereas that of the films grown by electron beam evaporation is close to polytype 4 H or 6 H. (20 refs.)

120171 Methods of determining optical constants of thin semiconductor films using normal incidence reflectance and transmittance data. D.R.Mckenzie, R.C.McPhedran, N.Savvides (School of Phys., Univ. of Sydney, Sydney, New South Wales, Australia), L.C.Botten, P.J.Martin, R.P.Netterfield.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.110-17 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Techniques for determining the optical constants of thin absorbing films are described and applied to the evaluation of the optical constants of carbon and silicon amorphous semiconductor films prepared by magnetron sputtering and ion beam sputtering techniques. The results are discussed with emphasis on the nature and origin of the optical gaps. (6 refs.)

120172 Physical and electrochemichromic properties of RF sputtered tungsten oxide films. K.Miyake, H.Kaneko, N.Suedomi, S.Nishimoto (Faculty of Engng., Yamaguchi Univ., Ube, Japan).
J. Appl. Phys. (USA), vol.54, no.9, p.5256-61 (Sept. 1983).
The physical and electrochemichromic properties of RF sputtered tungsten oxide films from a compressed powder WO_3 target have been investigated. This report mainly concerns the dependence of the properties on the total pressure of the sputtering atmosphere. The oxide films, 5000-5300 Å thick, were deposited on substrates maintained at 200°C under total pressures of 5×10^{-3}-8×10^{-2} Torr in an atmosphere of Ar gas or Ar-5% O_2 mixture. The physical and electrochromic properties of the oxide films prepared are dependent on the total pressure during deposition. The electrical resistivity ranges from 4.75×10^{7} to 3.33×10^{11} Ω cm depending on the pressure. From X-ray analysis, the films prepared under pressures of 5×10^{-3}-1.5×10^{-2} Torr were found to be crystalline and assigned a composition of $WO_{2.83}$. The films prepared under pressures of 1.8×10^{-2}-8×10^{-2} Torr were found to be amorphous. Electrochemical coloration of these oxide films was observed using an asymmetric cell, and the coloration characteristics of the oxide films were found to be dependent on the electrical resistivity and structure of the films. The amorphous films with high resistivity have good electrochromic properties, but the crystalline films with low resistivity are hardly colored. The optical band gap, refractive index, and density of the oxide films are described. (14 refs.)

120173 Optical properties of laser-melt-quenched Au-Si alloys. E.Huber, M.von Allmen (Inst. of Appl. Phys., Univ. of Bern, Bern, Switzerland).
Phys. Rev. B (USA), vol.28, no.6, p.2979-84 (15 Sept. 1983).
Glassy films of Au-Si alloys were produced by nanosecond laser quenching in the composition range from 25-93 at.% Si. Reflection and transmission coefficients as well as electrical conductivity were measured from 1.4 to 5.4 eV. The complex dielectric function, obtained from Kramers-Kronig analysis, is presented. The optical properties of the Au-Si system over the whole phase diagram can be described using a Lorentz-Drude model with a free-electron term and a single-resonance bound-electron term. The authors conclude that two electronic transitions occur in the system: Si switches between the metallic and the semiconducting state at about 30 at.% Si, whereas Au switches from the metallic to a dielectric state at about 85 at.% Si. These two transitions of the constituents separate three regions of markedly different electronic behavior in the alloy. (41 refs.)

120174 Interference effects in detachment of surface electromagnetic waves from the edge of a metal substrate. E.A.Yakovlev, V.A.Sychugov, A.A.Khakimov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.364-5 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.611-12 (March 1983). [received: Oct. 1983]
It is shown that the distribution of surface electromagnetic waves in the far-field zone has distinct maxima and minima. It is shown that interference in a surface electromagnetic wave, which becomes detached from the edge of a metallized substrate, with a wave which is scattered by a device used to excite the surface wave and which propagates along the substrate, can account satisfactorily for the nature of the resultant distribution of radiation. (4 refs.)

120175 Influence of structure and surface behaviour on thin film light scattering. G.Schirmer, E.Hacker, U.Bergner, A.Biedermann, H.-G.Walther (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.77-85 (1983). In German.
Light scattering from optical films arises primarily from the structural irregularities in the volume as well as from microrough interfaces. In this work the authors describe some structural and interfacial influences on the stray light from optical films made of SiO_x, TiO_2 and Ta_2O_5 as well as mixtures made of Ta_2O_5/SiO_x and Ta_2O_5/TiO_2. (9 refs.)

Synthesis of optical films during oblique incidence of light ... See Entry 118074

Non-linear susceptibility of Langmuir-Blodgett polydiacetylene thin films .... See Entry 118212

TeO_x thin films for an optical disc memory .... See Entry 118237

Theoretical investigation on the applicability of the ATR-technique to thin-films measurements by guided waves .... See Entry 118272

Doping kinetics of polyacetylene in the short range .... See Entry 119042

Growth and photoluminescence spectra of high-purity liquid phase epitaxial $In_{0.53}Ga_{0.47}As$ .... See Entry 119363

Oxygen-bonding environments in glow-discharge—deposited amorphous silicon-hydrogen alloy films .... See Entry 119367

Nitrogen-bonding environments in glow-discharge-deposited *a*-Si:H films .... See Entry 119368

Structural and optical studies of topotaxially-grown Cu_2S from sprayed CdS thin films .... See Entry 119374

Spectral studies on the electronic structure of polyacetylene . See Entry 119408

Trends in optical parameters and band structure with increasing hydrogenation of amorphous silicon ...... See Entry 119418

Erasable optical switching in semiconductor organic charge-transfer complexes ...... See Entry 119445

Discrete intragap Pb states in $Pb_{1-x}Sr_xS$ ...... See Entry 119499

Wide optical gap, undoped, photoconductive a-Si_xN_{1-x}:H prepared by DC sputtering ...... See Entry 119662

Electrical, optical, and structural properties of semitransparent metallic layers ...... See Entry 119718

Electrical conductivity of doped polyacrylonitrile (PAN)$^+$ ...... See Entry 119730

Ion plated transparent conductive films ...... See Entry 119732

Optical properties of $In_{0.5}Ga_{0.5}P$ epitaxial films ...... See Entry 120011

Electrooptical properties of thin films of polyheterocycles ...... See Entry 120025

Identification of residual donors in high-purity epitaxial GaAs with the use of magneto-optical spectroscopy ...... See Entry 120035

Optical properties of heavily doped polyacetylene films ...... See Entry 120063

Doping of polyparaphenylene—a spectroscopic study of thin transparent films ...... See Entry 120108

Determination of the nitrogen doping of liquid phase epitaxy GaP and $Ga_xIn_{1-x}P$ alloys by optical absorption and photoluminescence ...... See Entry 120114

Photoluminescence and lattice mismatch in InGaAs/InP ...... See Entry 120124

Low temperature photoluminescence of *n*-type GaInAsP layers grown on InP by liquid phase epitaxy ...... See Entry 120127

Luminescence and magnetic resonance in post-hydrogenated microcrystalline silicon ...... See Entry 120147

Recent progress on LADA growth of HgCdTe and CdTe epitaxial layers ...... See Entry 120244

Transparent conducting zinc oxide and indium-tin oxide films prepared by modified reactive planar magnetron sputtering ...... See Entry 120246

Radio-frequency sputtered indium tin oxide thin films ...... See Entry 120248

Growth of low dislocation density CdTe films on hydroplaned CdTe substrates by molecular beam epitaxy ...... See Entry 120252

Cis-trans isomerization of polyacetylene ...... See Entry 120611

78.70 OTHER INTERACTIONS OF MATTER WITH PARTICLES AND RADIATION

78.70B Positron annihilation

(see also 71.65 Positron states)

120176 Positron annihilation as a probe of electronic density in the two-dimensional conductor 1T-TaS_2. F.Boileau, B.Geffroy, R.Paulin (Inst. Nat. des Sci. et Tech. Nucleaires, CENS, Gif sur Yvette, France), P.Molinie, L.Zuppiroli.
J. Phys. (France), vol.44, no.10, p.1157-66 (Oct. 1983).
Tantalum disulfide is a layered compound with quasi-two-dimensional electronic conduction. The particular topology of the 2D-Fermi surface causes the onset of charge density waves which drive a metal-to-insulator phase transition in two steps. Three standard positron annihilation techniques have been used to sample the electronic density and momentum distributions in this compound as a function of temperature from 4 to 400K. The positron lifetime is 261(2)ps at 300K (single component) and does not change very much with temperature. It increases to 293(2)ps in a sample containing 1% of irradiation induced defects. The anisotropy of the momentum distribution is clearly visible both in angular correlation and Doppler broadening experiments. (22 refs.)

120177 On the temperature dependence of the positron annihilation spectrum from a single crystal of zinc. P.Rice-Evans, A.A.Berry, I.Chaglar (Dept. of Phys., Bedford Coll., London, England).
J. Phys. F (GB), vol.13, no.10, p.2197-201 (Oct. 1983).
The Doppler-broadened positron annihilation spectrum from a single crystal of zinc has been studied as a function of temperature and of the direction of photon emission. An anisotropy in the behaviour of the spectrum line height parameter was observed in the prevacancy temperature region with linear slopes $0.60\times10^{-4}K^{-1}$ in the [0001] direction and $1.02\times10^{-4}K^{-1}$ for [1010]. Optimum fittings with the two-state trapping model gave differing values for the monovacancy formation enthalpy, implying an inadequacy in the present understanding of the prevacancy rise. (13 refs.)

120178 The annihilation of the positron: a nondestructive research tool. A.E.Hughes.
Rev. Polytech. (Switzerland), no.8bis, p.1018-20 (Aug. 1983). In French.
The positron was discovered half a century ago. In the last fifteen years (1968-83), research on the way in which positrons are annihilated by electrons in solids can provide much information on defects in crystal lattices. This has led to the development of a new method of nondestructive testing. (no refs.) *J.S.*

Two-dimensional angular correlation of positron annihilation radiation in paramagnetic chromium ...... See Entry 119400

78.70C X-ray scattering

Local structure of amorphous $Mo_{50}Ni_{50}$ determined by anomalous X-ray scattering using synchrotron radiation ...... See Entry 119370

Photoelectron emission and reflection in dynamic scattering of an almost parallel X-ray beam ...... See Entry 120224

78.70D X-ray absorption and absorption edges

120179 Theoretical studies of the X-ray absorption near-edge structures (XANES) of hydrogen adsorbed metals. T.Matsuura, T.Fujikawa, H.Kuroda (Faculty of Engng., Yokohama Nat. Univ., Yokohama, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3275-82 (Sept. 1983).
The authors theoretically investigate the possibility of obtaining information about hydrogen adsorption on meals by XANES spectroscopy. The theoretical method used in this study was proposed by the present authors. Three metals are chosen for the substrates; Ni, W and Pt. The calculated results show that the XANES spectroscopy is useful only for H on W system. In the other two systems observable changes caused by hydrogen adsorption are not observed in the XANES spectra.

120180 Experimental atom-to-solid L-level shifts for Ce, Sm, Gd, and Er. G.Materlik (DESY, Hamburg, Germany), B.Sonntag, M.Tausch.
Phys. Rev. Lett. (USA), vol.51, no.14, p.1300-3 (3 Oct. 1983).
The X-ray L absorption spectra were measured for the atomic rare-earth elements Ce, Sm, Gd, and Er. From the energy positions of well resolved absorption lines at threshold in comparison to the corresponding solid-state spectra the atom-to-metal shifts of the core-level binding energies have been determined. For Sm and Er which undergo a valence change on formation of the solid the shifts differ by more than 6 eV from those of Ce and Gd which have the same configuration in the atom and the solid. (19 refs.)

120181 Study of Cu K edge in some copper (II) octahedral complexes. P.Bhattacharya, A.R.Chetal (Dept. of Phys. & Math., Indian School of Mines, Dhanbad-Bihar, India).
Phys. Status Solidi b (Germany), vol.119, no.1, p.179-83 (1 Sept. 1983).
The K-absorption edge of copper in the complexes $Cu(LH)_2SO_4.4H_2O$, $Cu(LH)SO_4.4H_2O$, and $Cu(phen)(xant)_2$ is investigated using a Cauchois-type bent crystal X-ray spectrograph. The peaks A, B, and C observed in the edges are explained on the basis of molecular orbital theory. Peak positions are correlated with partial charge on the central metal ion. It is observed that the peak A shifts to the low-energy side while the peaks B and C shift to the high-energy side as the partial charge on an absorbing ion in the complex increases. (22 refs.)

120182 Data analysis in extended X-ray-absorption fine structure: determination of the background absorption and the threshold energy. J.J.Boland, F.G.Halaka, J.D.Baldeschwieler (Div. of Chem. & Chem. Engng., California Inst. of Technol., Pasadena, CA, USA).
Phys. Rev. B (USA), vol.28, no.6, p.2921-6 (15 Sept. 1983).
Two approaches for the determination of the background absorption (μ_0) in the extended X-ray-absorption fine structure (EXAFS) are presented. Both methods, experimental and computational, take advantage of the damping of the EXAFS amplitude resulting from the convolution with Gaussian functions of different widths. In the experimental method two or more spectra are collected with the use of different spectrometer slit widths, resulting in spectra of different resolutions for the same sample. In the computational approach the convolution is accomplished via a convolution algorithm. The interesection points of the resulting spectra are used to generate μ_0. At the absorption edge, the spectra intersect at a unique point, which is shown to be a measure of the threshold energy, E_0. Illustration of the two methods for background removal is given for a copper-foil sample. The computation approach is superior to the experimental method of damping the EXAFS spectra to give μ_0. (10 refs.)

120183 *K*-shell excitation of D_2O and H_2O ice. Photoion and photoelectron yields. R.A.Rosenberg, P.R.LaRoe, V.Rehn (Michelson Labs., Naval Weapons Center, China Lake, CA, USA), J.Stohr, R.Jaeger, C.C.Parks.
Phys. Rev. B (USA), vol.28, no.6, p.3026-30 (15 Sept. 1983).
The yield of photoelectrons and photoions from condensed H_2O and D_2O ice near and above the oxygen *K* edge is reported. Results of studies in the near-edge region indicate that Rydberg excitations, which are quenched in the bulk, survive, to some extent, on the surface. Analysis of the extended X-ray absorption fine structure of the photoelectron yield above the edge yields an oxygen-oxygen scattering phase shift in good agreement with theory. (36 refs.)

120184 Extended X-ray-absorption fine-structure study of anharmonicity in CuBr. J.M.Tranquada, R.Ingalls (Dept. of Phys., Univ. of Washington, Seattle, WA, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3520-8 (15 Sept. 1983).
The extended X-ray-absorption fine structure (EXAFS) above the Cu and Br *K* edges in CuBr has been measured at 72, 210, and 295K. The first-shell contributions were isolated by Fourier filtering the EXAFS data, and the resulting single-shell data were analyzed using the ratio method. It is found that the third and fourth cumulants of the nearest-neighbor distance distribution are quite significant even at 210K and cannot be ignored when making least-squares fits to amplitude ratios and phase differences. At 295K the authors obtain values of $(0.37\pm0.05)\times10^{-3}$ Å^3 and $(0.72\pm0.12)\times10^{-4}$ Å^4 for the third and fourth cumulants, respectively, as well as an anharmonic contribution of $(0.16\pm0.12)\times10^{-2}$ Å^2 to the mean-square relative displacement. The data cannot be explained by a disorder model in which a Cu ion is allowed to occupy four equivalent off-center sites as well as its ideal position; the non-Gaussian contribution must be due to intrinsic anharmonicity. Interpretation of the results in terms of an anharmonic effective single-particle potential for the Cu ions indicates that the fourth-order potential term is just as important as the third and cannot be neglected. This model gives a reasonable description of the temperature dependence of the second, third, and fourth cumulants. (45 refs.)

120185 Anomalous saturation of mixed valence in cerium-based systems as studied by X-ray absorption. R.D.Parks, S.Raaen, M.L.denBoer, V.Murgai (Dept. of Phys., Polytech. Inst. of New York, New York, NY, USA), T.Mihalisin.
Phys. Rev. B (USA), vol.28, no.6, p.3556-8 (15 Sept. 1983).
The mixed valence of cerium-based metallic systems, as determined, for example, by X-ray-absorption experiments, never rises above 3.2-3.3. The L_{III} absorption-edge studies reported here show that this saturation effect occurs abruptly as a function of lattice constant (or composition) in the pseudobinary system $Ce(Pd_{1-x}Rh_x)_3$, in which it is possible to vary both continuously and rapidly the electronic properties. The saturation anomaly (at the valence 3.21) occurs at $x\approx0.2$, the composition where anomalous saturation effects have been previously observed in the magnetic susceptibility, electronic specific heat, and electrical resistivity. The values of the latter quantities at $x\approx0.2$ suggest a valency of $\sim$4, when interpreted within the promotional model. (11 refs.)

120186 Near-in fine structure of the $L_{2,3}$ absorption spectrum of metallic titanium. V.N.Sivkov, A.S.Vinogradov (A.A. Zhdanov State Univ., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.515-17 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.897-9 (March 1983). [received: Oct. 1983]
More detailed information on the near-in fine structure of the $L_{2,3}$ absorption spectra of Ti can be obtained by determining the spectral dependence of the absorption cross section σ for metallic titanium directly by the transmission method. The near-in fine structure of the $L_{2,3}$ absorption spectra of titanium was investigated by the X-ray photoabsorption method using an RSM-500 X-ray spectrometer-monochromator. The structure was determined using bremsstrahlung emitted by a tungsten anode of an X-ray tube. (11 refs.)

Cryostat for testing luminescence and radiation absorption in ionic crystals .... See Entry 117185

Manifestation of X-ray absorption in calcium hexaboride and lanthanum hexaboride .... See Entry 118818

X-ray diffraction and absorption spectrophotometric studies of AmI_3 and AmOI .... See Entry 118970

Split-off narrow *d*-band states above E_F in transition-metal alloys .... See Entry 119421

Electronic structure and X-ray near-edge core spectra of Cu_2O .... See Entry 119433

Mixed valence in $CeNi_5$; Effects of dilution and chemical pressure .... See Entry 119521

Spin-density calculations for core-electron photoemission and Auger electron line shapes, X-ray-edge exponents, and solid-state shifts .... See Entry 120222

78.70E X-ray emission threshold and fluorescence

120187 The anisotropy of X-ray emission spectra for 2H-MoS_2 single crystals. Yu.M.Yarmoshenko, V.M.Cherkashenko, E.Z.Kurmaev (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
J. Electron Spectrosc. & Relat. Phenom. (Netherlands), vol.32, no.2, p.103-12 (Sept. 1983).
The angular dependence of the polarised X-ray S $K\beta_1$ and Mo $L\beta_{2,15}$ spectra of single-crystal 2H-MoS_2 has been studied. A discussion of the experimental data obtained is performed on the basis of a local symmetry analysis of atoms. (19 refs.)

120188 Measurements of relative intensities of L shell X-rays in some high Z elements. S.Kumar, N.Singh, R.Mittal, K.L.Allawadhi, B.S.Sood (Dept. of Phys., Punjabi Univ., Patiala, India).
Natl. Acad. Sci. Lett. (India), vol.5, no.10, p.345-7 (Oct. 1982). [received: Oct. 1983]
The L shell X-ray relative intensities $I(L_{\alpha+1})/I(L_\beta)$ and $I(L_{\alpha+1})/I(L_\gamma)$ for Ta and $I(L_\alpha)/I(L_l)$, $I(L_\alpha)/I(L_\beta)$ and $I(L_\alpha)/I(L_\gamma)$ for Au, Hg, Tl and Bi have been measured for 59.57 keV gamma ray excited fluorescent X-rays. The experimental results are found to agree well with theory. (5 refs.)

120189 The forbidden transition $L_1N_{6,7}$ in Europium-63. B.D.Shrivastava, D.C.Gaur (School of Studies in Phys., Vikram Univ., Ujjain, India).
Natl. Acad. Sci. Lett. (India), vol.5, no.12, p.431-3 (Dec. 1982). [received: Oct. 1983]
Using a 40 cm curved mica crystal spectrograph of the transmission type, a new diagram line at λ 1536.7 XU corresponding to the forbidden transition L_1 $N_{6,7}$ in europium has been reported for the first time. This has been possible by successfully eliminating the K-spectrum of copper which is usually present in the commercially available demountable X-ray tubes. (8 refs.)

120190 Angular dependent X-ray K emission bands of sulphur in SnS_2 and MoS_2. W.Muller, G.Wiech (Sektion Phys., Univ. Munchen, Munich, Germany), A.Simunek.
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.66-8 (3 Oct. 1983).
For the metal dischalcogenides SnS_2 and MoS_2 the angular dependent K emission bands of sulphur were measured and calculated. Results are presented for take-off angles 15° and 70°. The characteristic features of the emission bands are related to the s, p, d character and the energy localization of the valence electrons. (16 refs.)

120191 Angular dependences of the spectra of soft X-ray excitation potentials of single crystals. B.E.Blekher, I.A.Brytov, V.V.Korablev.
Sov. Phys.-Solid State (USA), vol.25, no.3, p.368-71 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.647-52 (March 1983). [received: Oct. 1983]
The existence of a nonmonotonic angular dependence of the amplitude in the spectra of soft X-ray excitation potentials was detected for the first time for single crystals. The effect was explained by the dynamic theory of diffraction. (12 refs.)

Electron configuration and X-ray emission spectra of intermetallic compounds with CsCl structure .... See Entry 119425

78.70G Microwave and radiofrequency interactions
(exc. resonances)

120192 Transmission of electromagnetic radiation through ferromagnetic metals via oblique magnons?. L.Kraus, D.Fraitova (Inst. of Phys., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Phys. Lett. A (Netherlands), vol.97A, no.9, p.417-20 (26 Sept. 1983).
A general secular equation for propagation vectors of waves propagating into a magnetically saturated ferromagnetic metal was obtained by a simultaneous solution of the Maxwell equations and Gilbert's equation of motion. It is shown that magnons propagating at oblique angles with respect to the normal of the surface of a tangentially magnetized sample have their penetration depths comparable with the classical skin-depth. It is proposed that oblique magnons may contribute to the transmission of electromagnetic radiation through a ferromagnetic metal. (15 refs.)

78.90 OTHER TOPICS IN OPTICAL PROPERTIES OF CONDENSED MATTER AND OTHER INTERACTIONS OF MATTER WITH PARTICLES AND RADIATION

Conditions for formation of polariton-like solitons and transmission of an ultrashort light pulse across a crystal-vacuum interface .... See Entry 119470

79.00 ELECTRON AND ION EMISSION BY LIQUIDS AND SOLIDS; IMPACT PHENOMENA

79.20 IMPACT PHENOMENA
(inc. electron spectra and sputtering)

Effect of gas on the electret charge reduction by radiation ... See Entry 119972

79.20F Electron impact: Auger emission

120193 Extended appearance-potential fine-structure analysis of Fe (110) surface. T.Ishida (Government Industrial Res. Inst., Osaka, Japan), H.Maeda, N.Kamijo, K.Ueda.
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.2973-5 (Sept. 1983).
In order to study the surface structure of a material, a method for detecting the extended appearance-potential fine-structure has been developed by measuring the peak-to-peak height of a particular Auger signal. Since Auger electron spectroscopy is highly sensitive to surface elements, the detection method is considered to be very useful to study atomic surface structures. The Fourier transform of the detected extended appearance-potential fine-structure curve of Fe (110) surface has exhibited a prominent peak at 2.47 Å, which is about 0.01 Å less than the nearest-neighbour bulk spacing in iron. (6 refs.)

120194 Intergranular segregation phenomena studied by AES. M.P.Seah (Div. of Materials Applications, NPL, Teddington, England).
J. Microsc. & Spectrosc. Electron. (France), vol.8, no.3, p.177-91 (1983). (Meeting of the French and Belgian Societies for Electron Microscopy, Liege, Belgium, 16-19 May 1983).
Grain boundary segregation is an important phenomenon for the mechanical behaviour of many materials as well as their electrical and kinetic integrity. The most common method of characterisation is by Auger electron spectroscopy (AES). In this review the basic principles and limitations of the characterisation by AES will be defined in terms of detectability, the spatial resolution of the information, the quantification of the measurement and the aspects of characterisation that are directly possible. The intentions of the measurments are twofold: (i) diagnostic and (ii) to build a reliable predictive theory for segregation and for the effects of segregants on materials' behaviour. The developments of the theory for both the equilibrium segregation and the kinetics are illustrated by examples of AES studies from many laboratories in simple binary systems, in ternaries, and more complex commercial steels. This allows a clear framework to be established for most materials. (63 refs.)

120195 Low energy electron contributions to appearance potential and disappearance potential spectra. TiL_3. R.Konishi, M.Kinoshita, Y.Miyada, S.Kato (Dept. of Electronics, Tottori Univ., Tottori, Japan).
Oyo Buturi (Japan), vol.52, no.6, p.522-8 (June 1983). In Japanese.
In the present experiments, the electron energy distributions contributing to the $L_{3,2}$ Auger electron appearance potential (AEAP) and disappearance potential (DAP) spectra were studied. The specimens were evaporated Ti films, which were exposed up to 150 Langmuir O_2. In the case of the virgin surface before the exposure, the energy value of the L_3 dip of AEAP spectrum did not change when the low energy true secondary electrons were removed using retarding potential method. However, after the O_2 exposure, shifts of 0.4~0.6 eV were observed. The intensity of the $L_{3,2}$ DAP spectrum involving inelastically scattered electrons increases more than that of the pure DAP spectrum. The L_3 dip of DAP spectrum shifts to the higher energy side after the O_2 exposure. The probing depth of AEAP spectroscopy is larger than DAP spectroscopy. (11 refs.)

120196 Investigation of in-situ sputtered a-Si(H) by AES. J.Zemek, S.Koc (Inst. of Phys., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Sol. Energy Mater. (Netherlands), vol.9, no.2, p.183-7 (July-Sept. 1983).
An in-situ Auger Electron Spectroscopic (AES) study of a-Si(H) and reference samples of freshly cleaved silicon (111) surface is reported. Further, the adsorption of oxygen up to the dose of 10^8 L has been investigated. Samples of a-Si(H) display a suppression of the Si $L_{23}M_{23}M_{23}$ transition and weaker tendency of their surface to molecular adsorption and oxidation. The dominant changes in spectra are attributed to Si-H bond character. (9 refs.)

120197 A simulation model for the secondary electron emission from metals. Application to the study of the Auger electron emission of aluminium. M.Cailler (Lab. de Phys. du Metal, Ecole Nat. Superieure de Mecanique, Nantes, France), J.-P.Ganachaud.
Scanning Electron Microsc. (USA), pt.1, p.85-97 (1983). (Scanning Electron Microscopy 1983 Conference, Dearborn, MI, USA, 17-22 April 1983).
In the authors' simulation, for the L_{23} VV Auger line of aluminium, the total Auger electron creation rate obtained by simulation is nearly 0.012 $Å^{-1}$ per incident electron near the surface for a primary energy of 1 keV and a normal incidence. The escape function estimated by the same method gives a result (~0.5) lower than that given by the exponential attenuation law. The discrepancy could come from the escape cone from the surface plasmon creation effects and from the elastic collisions suffered by Auger electrons along their path. The Auger yield obtained by multiplying the creation rate and the escape function is about 0.006 at 1 keV. The simulation model also allows a quantitative description of the secondary emission and of the transmission of electrons through thin films. (46 refs.)

Reproducibility of electron spectroscopy data with different analyzers .... See Entry 117290

The diffusivity of hydrogen in Nb stabilized stainless steel .... See Entry 119274

(HgCd)Te-SiO_2 interface structure .... See Entry 119353

Auger spectroscopy of metal-semiconductor interface in the In-$Pb_{1-x}Sn_xTe$ system .... See Entry 119354

Compound formation and bonding configuration at the Si-Cu interface .... See Entry 119356

On the chlorine content in chemically sprayed tin oxide films: a quantitative analysis .... See Entry 119372

Effects of vacuum annealing on the electronic properties of cleaved GaAs .... See Entry 119680

Spin-density calculations for core-electron photoemission and Auger electron line shapes, X-ray-edge exponents, and solid-state shifts .... See Entry 120222

Cleaning effect of rare earths on grain boundary segregation in steels .... See Entry 120331

Applications of AES and XPS to characterization of aluminium and its compounds .... See Entry 120696

79.20H Electron impact: secondary emission

Reproducibility of electron spectroscopy data with different analyzers .... See Entry 117290

A simulation model for the secondary electron emission from metals. Application to the study of the Auger electron emission of aluminium .... See Entry 120197

79.20K Other electron impact phenomena

120198 Low-energy electron energy-loss spectra associated with reconstructed structure on Si (111) surface. Y.Shigeta, K.Maki (Dept. of Phys., Yokohama City Univ., Yokohama, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.7, p.L391-3 (July 1983).
Low energy electron energy-loss spectra from the Si (111) surface were obtained under a surface wave resonance condition under which the wave vector of diffracted electrons is parallel to a row of the 1/7-order superlattice rods in 7×7 structure. A peak related to a surface dangling bond at 1.5 eV in the energy-loss value ΔE, and a peak due to the excitation of a surface plasmon at $\Delta E=8.5$ eV are enhanced at each height. Surface plasmon peak shifts to 10.5 eV when the condition is not satisfied. When the surface changes from a 7×7 structure to a 1×1, the decrease in these peak heights is also observed. (7 refs.)

120199 Energy spectrum of electrons of solid solutions in the TiC-TiN system. E.A.Zhurakovskii, M.I.Lesnaya, K.S.Proskurka, A.A.Sotnik (Inst. of Problems of Materials Sci., Acad. of Sci., Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.10, p.1478-82 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1721-5 (Oct. 1982). [received: Sept. 1983]
The results of the investigation of the spectra of solid solutions in the TiC-TiN system showed that it consists of individual, partially overlapping bands, which are generally related to the carbon and nitrogen 2s and 2p states and on the Ti 3d and 4s states and that the chemical bonding gradually changes its character from almost covalent in the solid solutions close in composition to TiC to metallic-covalent in the solid solutions close in composition to TiN. (14 refs.)

120200 Energy spectra of backscattered electrons for solid films and double layers by use of Werner's analytic model. S.Rogaschewski (Sektion Phys., Humboldt-Univ. zu Berlin, Berlin, Germany).
Phys. Status Solidi a (Germany), vol.79, no.1, p.149-59 (Sept. 1983).
Expressions for the energy spectrum of electrons backscattered from solid films and double layers as a function of incident electron energy, angle of incidence, film thickness, and atomic number of target are derived from Werner's analytic model (1978). Values calculated from these expressions agree well with existing experimental and Monte Carlo data. (31 refs.)

120201 Orientation dependence of core edges from anisotropic materials determined by inelastic scattering of fast electrons. R.D.Leapman, P.L.Fejes, J.Silcox (School of Appl. & Engng. Phys., Cornell Univ., Ithaca, NY, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2361-73 (1 Sept. 1983).
Electron-energy-loss spectra have been measured in the region of the *K* edges in graphite and hexagonal boron nitride. The fine structure is found to be strongly dependent on the crystal orientation and momentum transfer. Angular distributions of peaks in the spectrum have been recorded from crystals with the *c* axis parallel and at 45° to the beam direction. These agree well with the theoretical distributions for transitions to π^* and σ^* final states in a hybridised atomic-orbital model. Peaks in the energy-loss spectrum are compared with band calculations of the ground-state density of states. Some correspondence is found between these but there is also evidence of core excitons. (43 refs.)

120202 Double losses and overtones in electron-energy-loss studies of surface vibrations: the role of lateral interactions. J.C.Ariyasu, D.L.Mills (Dept. of Phys., Univ. of California, Irvine, CA, USA).
Phys. Rev. B (USA), vol.28, no.5, p.2389-402 (1 Sept. 1983).
Within a simple model of an ordered overlayer of adsorbed molecules on a crystal surface, the authors develop a theory of two-phonon losses in the regime of small-angle scattering, where dipole losses dominate. Two features which correspond to a double loss and excitation of an overtone are identified in the model, and they study the role of lateral interactions on each of the these. They find that the lateral interactions shift the overtone relative to the double loss; the overtone loss band may also have both its width and shape influenced significantly. The implications of these results are discussed, most particularly as they relate to estimates of dissociation energies by the Birge-Sponer extrapolation procedure. (13 refs.)

An electron energy-loss bibliography .... See Entry 116938

New high resolution electron spectrometer for surface vibrational analysis .... See Entry 117281

Reproducibility of electron spectroscopy data with different analyzers .... See Entry 117290

Thermal transformation of local to extended electronic states in polyacrylonitrile .... See Entry 119416

π electron delocalization in poly-(p-phenylene) (PPP), polyphenylene sulfide (PPS) and polyphenylene oxide (PPO) and AsF_5 doping of PPP .... See Entry 119417

Dielectric properties of polyacetylene .... See Entry 119490

***K*-shell excitation of D_2O and H_2O ice. Photoion and photoelectron yields** .... See Entry 120183

79.20N Atom, molecule, and ion impact

120203 Surface ion-electron emission from metals. M.Soszka, W.Soszka (Inst. of Phys., Jagellonian Univ., Cracow, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.3, p.255-61 (Sept. 1983).
Ion bombardment of the nickel polycrystalline target covered by adsorbed and contaminant particles leads to the escape of surface electrons with discrete energies which are characteristic for covering particles (surface ion-electron emission—SIEE). Surface electrons leave the polycrystalline target in distinctly defined directions relative to the escape of the recoil particles but independently of the incident angle. This fact suggests that anisotropy has an elementary character and, probably, it is connected with a manner of electron creation. From angular profiles the energy spectrum of surface electrons was reconstructed. The position of the peaks on the reconstructed energy distribution curve is extremely stable in the time. It was found that SIEE depends on the bombarding time, ion beam density, energy of projectiles and gas exposure of the target. A simple model of the surface ion-electron emission from the real surface of metals is discussed. (6 refs.)

120204 Modification of the surface due to ion bombardment: an XPS study. F.Werfel, E.Suoninen.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.171-6 (1983).
XPS valence band measurements have been used to observe the surface alteration of transition metal oxides due to Ar^+ ion bombardment. V_2O_5 and MoO_3 surfaces change under ion bombardment to lower oxidation states. Sputtering of Pd metal causes drastic XPS valence band changes. (17 refs.)

120205 Detection of surface atoms by energy analysis of scattered primaries and recoiled secondaries from CsBr under Ar^+ and Ar^{2+} bombardment. J.A.Schultz, R.Kumar, J.W.Rabalais (Dept. of Chem., Univ. of Houston, Houston, TX, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.214-18 (9 Sept. 1983).
Time-of-flight (TOF) and electrostatic sector analysis (ESA) have been used to measure particles scattered and sputtered by direct recoils and surface recoils during 3 keV Ar^+ and 6 keV Ar^{2+} bombardment of CsBr at forward and backscattering angles. Charge fractions of scattered argon and recoiling surface atoms are obtained. Hydrogen and oxygen surface impurities are detected predominantly as directly recoiled neutrals. (17 refs.)

120206 A double rainbow interpretation of rotational energy transfer in energetic NO/Ag(111) collisions. H.Voges, R.Schinke (Max-Planck-Inst. fur Stromungsforschung, Gottingen, Germany).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.245-50 (9 Sept. 1983).
The mechanism of rotational energy transfer in energetic ($E \lesssim 1$ eV) NO/Ag(111) collisions is investigated in quantal rigid-rotor/static-surface calculations. Reasonable agreement with recent experimental results is obtained for the case of a strongly asymmetric interaction potential which leads to two well-separated rotational rainbows at low and at high $E_{\rm rot}$, respectively. (24 refs.)

120207 Erosion of polymer thin films during ion bombardment. M.Braun, B.Emmoth, G.M.Mladenov, H.E.Satherblom (Res. Inst. of Phys., Stockholm, Sweden).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1383-7 (1983).
Thin films of photoresist material (PMMA and AZ 1450J) have been irradiated by H^+ and He^+ ions in the low MeV energy region. The composition and thickness of the irradiated layers were determined by RBS techniques. It was found that the composition of the PMMA layer is subject to a drastic change in the initial state of the ion bombardment. The erosion rates of the polymer materials were also measured and were found to vary between 100-20000 atoms/incoming ion. This could not be explained by conventional sputtering theories. It is assumed that these high erosion rates and compositional changes are connected with the electronic losses of the bombarding ions, giving rise to a bond breaking phenomenon of the resist molecules. (17 refs.)

120208 Sputtering negative carbon ions from cesiated graphite surfaces. A.Pargellis, M.Seidl (Dept. of Phys., Stevens Inst. of Technol., Hoboken, NJ, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1388-93 (1983).
The sputtering of negative carbon ions from graphite targets bombarded with Cs^+ ions has been studied. The energy of the Cs^+ ions has been varied from 200 V to 20 kV. The targets studied were polycrystalline, pyrolytic and vitreous graphite. The negative ion yield strongly depends on the amount of cesium adsorbed on the surface and intercalated into the bulk of the graphite. The optimum C^- ion yield is 0.5 to 0.6 C− ions per incident Cs+ ions for a bombarding energy of 10 keV and for a target temperature of 200°C. The yield is independent of the graphite structure. In addition to C^- ions, negatively charged clusters of carbon ions up to C^-_{19} were sputtered from polycrystalline and pyrolytic graphite. Sputtering from vitreous graphite produces only light clusters, up to C^-_4. (21 refs.)

120209 Chemical sputtering of carbon by sub-eV atomic hydrogen: new results and a critical comparison with previous data relevant to fusion applications. P.C.Stangeby, O.Auciello, A.A.Haasz (Inst. for Aerospace Studies, Univ. of Toronto, Downsview, Ontario, Canada).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1425-9 (1983).
The production of methane on carbon (papyex) surfaces under sub-eV atomic hydrogen bombardment has been measured in an ultrahigh vacuum system subjected to special cleaning procedures. These results and previously published methane yield results are compared and their applicability to fusion technology is assessed. A critical analysis of the available data leads to the following conclusions: (i) The inconsistent methane yields spanning four orders of magnitude are most likely due to different experimental procedures. (ii) The monotonically decreasing methane yield as a function of sample temperature, obtained by some groups, is most probably due to the fact that deactivated surfaces were exposed to hydrogen bombardment. (iii) The methane yields which present a maximum at a certain temperature in the range 700-850K resulted from bombardment of activated surfaces; and (iv) the shift in temperature at which the methane yield maximum occurs in the different studies may be due to temperature nonuniformities over the exposed surfaces and/or different states of activation. (21 refs.)

120210 Electron transfer in the reflection of ions/atoms from metal surfaces using the time-dependent Newns-Anderson Hamiltonian. K.L.Sebastian (Inst. fur Phys. Chemie, Univ. Munich, Munich, Germany).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.39-43 (3 Oct. 1983).
A procedure for taking electron correlation into account in the transfer of electrons to or from ions/atoms reflected from metal surfaces is suggested. The procedure makes use of the fact that the time-development operator for a two-body Hamiltonian can be written as a functional average of the time-development operator for a one-body Hamiltonian. Using this, the transfer probability is written as a functional integral. Finding the stationary path of the 'action' of this functional integral leads to time-dependent Hartree-Fock (TDHF) like equations. These equations are more complicated than TDHF equations, but have the advantage of going beyond the TDHF theory. (8 refs.)

120211 Neutral-atom scattering from random isolated adsorbate atoms on clean metal surfaces: oxygen and carbon monoxide on nickel (001). J.Ibanez, N.Garcia (Dept. de Fisica Fundamental, Univ. Autonoma de Madrid, Canto Blanco, Madrid, Spain), J.M.Rojo.
Phys. Rev. B (USA), vol.28, no.6, p.3164-72 (15 Sept. 1983).
The intensity I of the specular beam of a helium nozzle beam scattered from a Ni(001) surface has been measured as a function of adsorbate coverage Θ for both oxygen and CO exposures at 350K for different angles of incidence. A linear relationship is found between ln (I/I_0) (I_0, the intensity of the specular beam from the clean surface) and Θ up to $\Theta=0.15$ monolayer of O on Ni and $\Theta=0.1$ monolayer of CO on Ni. A model is proposed in which the scattering is governed by the repulsive part of the gas-surface potential, the latter being described by a hard-wall corrugation. A constant attractive well depth and a temperature-dependent vibration amplitude of the atoms are also incorporated into the model. The adsorbate atoms are treated as a shot noise on a flat metal surface. By means of suitable averaging, a formula is found that explains the linear dependence indicated. From the best fit of the model to the experimental data, a set of parameters describing the corrugation of a single adsorbate is derived. Cross sections for the helium-adatom scattering are 65 and 26 Å² for CO and O, respectively. The corresponding corrugations have been fitted with Gaussians of height 0.62 Å (for CO) and 0.32 Å (for O). (26 refs.)

120212 Comparison of specular H-atomic-beam intensity and C^+ secondary-ion yield at thermally activated decrease of a carbon layer on a Ni (110) surface. H.Kaarmann, H.Hoinkes, H.Wilsch (Phys. Inst., Univ. Erlangen-Nurnberg, Erlangen, Germany).
Phys. Rev. B (USA), vol.28, no.6, p.3561-3 (15 Sept. 1983).
The thermally activated disappearance of a carbon layer on a Ni (110) surface was investigated by the scattering of atomic hydrogen and by secondary-ion mass spectrometry. Decreasing C coverage at surface temperatures kept constant in each case at values between 650 and 750K resulted in an exponential decrease of specular H-beam intensity as well as C^+ secondary-ion yield. This decrease in both cases fits first-order kinetics (presumable diffusion into the bulk) with an identical rate constant as a function of surface temperature and results finally in a preexponential frequency $\nu=10^{(10\pm1)}$ s^{-1} and an activation energy $E_A=1.8\pm0.2$ eV. (9 refs.)

120213 Secondary ion mass spectroscopy applications in semiconductor technology: III-V compound and other material structures. T.Ambridge (British Telecom Res. Labs., Ipswich, England).
Scanning Electron Microsc. (USA), pt.1, p.31-43 (1983). (Scanning Electron Microscopy 1983 Conference, Dearborn, MI, USA, 17-22 April 1983).
Secondary ion mass spectrometry (SIMS) is becoming widely applied to problems in semiconductor technology, as exemplified by the following: a) trace analysis down to 1 part in a thousand million (ie about 5×10^{13} cm^{-3}) is routinely achieved for many important donors and acceptors (e.g. Si, Se, Te, B, in GaAs). b) detailed depth profiles in GaAs grown by molecular beam epitaxy have clearly identified two problems: i) close compensation of intentional S donors by Mn acceptors, at the mid 10^{15} cm^{-3} level, incorporated from a spurious source; ii) absence of intended Sn donors, but presence of Te donors at the mid 10^{17} cm^{-3} level, ascribed to impurity of the As source material; c) the uniformity of low dose Se ion implantation (2.25×10^{12} cm^{-2} at 225 keV energy) over a 50mm diameter GaAs wafer has been mapped, confirming it to be within better than about ±10%, except within an unexpected uniplanted region which was revealed. More advanced applications to multilayer III-V alloy semiconductor structures (for lasers), integrated circuits, and optical fibres are briefly touched upon. Strong emphasis is placed on the complexities, and potential pitfalls in SIMS data interpretation, related to mass interferences, surface contamination, choice of instrumental conditions and the quantification procedures. (27 refs.)

Depth profile of hydrogen in thin films with elastic recoil detection technique ....See Entry 119049

Analysis of hydrogen concentration and its depth profile in solid with detection of H(d,p) recoil ....See Entry 119050

Kinetics of radiation-induced segregation in Ni-12.7 at.% Si ....See Entry 119073

Residual shallow acceptors in GaAs layers grown by metal-organic vapor phase epitaxy ....See Entry 119364

On the chlorine content in chemically sprayed tin oxide films: a quantitative analysis ....See Entry 119372

Ion-bombardment-induced whisker formation on graphite ....See Entry 119379

The reactive sputtering of tantalum oxide: compositional uniformity, phases, and transport mechanisms ....See Entry 120245

A simple, inexpensive device for ion-bombardment cleaning of samples in ultrahigh vacuum ....See Entry 120463

79.20R Atomic and molecular beam interactions

Neutral-atom scattering from random isolated adsorbate atoms on clean metal surfaces: oxygen and carbon monoxide on nickel (001) ....See Entry 120211

Comparison of specular H-atomic-beam intensity and C^+ secondary-ion yield at thermally activated decrease of a carbon layer on a Ni (110) surface ....See Entry 120212

79.40 THERMIONIC EMISSION

120214 Emission characteristics of single-crystal LaB_6 cathodes with large tip radius. Y.Furukawa, M.Yamabe, T.Inagaki (Fujitsu Labs. Ltd., Atsugi-shi, Japan).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1518-21 (1983).
Emission characteristics of single-crystal LaB_6 cathodes of ⟨100⟩, ⟨110⟩, ⟨111⟩, ⟨210⟩, ⟨310⟩, and ⟨321⟩ orientations, with large tip radius (100 μm), were investigated. In cathodes of small tip radius (less than 10 μm) emission from the conical face is dominant, as it has the small area of the top surface. Cathodes of large tip radius have a large emission area at the top surface, which includes various crystal faces, according to the orientation and the cone angle. It has become clear that it is important to use as the tip axis the orientation having rotational symmetry and a crystal face of low work function at the cathode top to get good beam uniformity. In this respect the ⟨100⟩ cathode was found to be superior to cathodes of other orientations. Emission characteristics of the ⟨100⟩ cathode during long-term operation were investigated. A flat (100) face was formed at the top due to LaB_6 material consumption, and emission characteristics reflecting this tip shape were measured. (8 refs.)

79.60 PHOTOEMISSION AND PHOTOELECTRON SPECTRA

120215 Core-level photoelectron spectroscopy of surfaces and adsorbates. T.-C.Chiang (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Comments At. & Mol. Phys. (GB), vol.13, no.6, p.299-309 (1983).
Recent experiments in photoemission from core levels for surfaces and adsorbates are reviewed. Core level shifts for single crystal surfaces relative to the bulk as well as core level shifts induced by adsorption are discussed. The relationships between the observed shifts and the surface electronic properties and the surface atomic structures are illustrated. Several examples are adsorbed rare gases, semiconductor and metals surfaces and their interfaces are presented. (22 refs.)

120216 XPS studies of vanadium and vanadium oxides. J.Kasperkiewicz, J.A.Kovacich, D.Lichtman (Phys. Dept., Univ. of Wisconsin-Milwaukee, Milwaukee, WI, USA).
J. Electron Spectrosc. & Relat. Phenom. (Netherlands), vol.32, no.2, p.123-32 (Sept. 1983).
XPS (ESCA) measurements are presented of the X-ray-induced photoelectron lines and Auger transitions of metallic vanadium and of two vanadium oxides. The oxidation states of vanadium are compared and discussed for vanadium in the maximal valence state, with a $3d^0$ electron configuration, and in the state with a $3d^1$ electron configuration. (11 refs.)

120217 d-orbital-directed X-ray photoemission from some transition-metal fluoride single crystals and associated calculations. K_2FeF_5. K.Broomfield, P.M.A.Sherwood (Dept. of Inorganic Chem., Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1321-9 (Sept. 1983).
Angle-resolved photoemission energy distributions (PED) have been obtained from the valence and core regions of a single crystal of potassium iron(III) fluoride (K_2FeF_5) using Mg $K\alpha$ radiation. Ground state SCF $X\alpha$ calculations on the $FeF_6{}^{3-}$ cluster showed that the bonding e_g and t_{2g} orbitals had more metal 3*d* character than the antibonding orbitals of the same symmetry type, so that one could expect to see *d*-orbital-induced angular variation in most regions of the spectrum. The observed PED were found to be consistent with the matrix-element model when both *p*- and *d*-orbital effects were taken into account, and peak separations were determined by an SCF $X\alpha$ transition-state calculation on the $FeF_6{}^{3-}$ cluster. (11 refs.)

120218 XPS spectra of $BF_4{}^-$ doped polypyrrole in states of different conductivity. R.Erlandsson, I.Lundstrom (Dept. of Phys. & Measurement Technol., Linkoping Univ., Linkoping, Sweden).
J. Phys. Colloq. (France), vol.44, no.C-3, p.713-15 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors have measured the N(1s) binding energy of polypyrrole in states of different conductivity using XPS. The conductivity changes were produced either electrochemically or chemically by a base/acid treatment. In both cases reversible effects on the N(1s) photoelectron spectrum were observed. (6 refs.)

120219 Cooper-minimum effects in the photoionization cross sections of 4*d* and 5*d* electrons in solid compounds. G.Rossi, I.Lindau (Stanford Electronics Labs., Stanford Univ., Stanford, CA, USA), L.Braicovich, I.Abbati.
Phys. Rev. B (USA), vol.28, no.6, p.3031-42 (15 Sept. 1983).
The authors present experimental determinations of the cross section for photoionization for 4*d* and 5*d* valence states in transition and noble metals and at the interfaces that these metals form with elemental semiconductors (group IV) in the photon-energy range $h\nu=70$-200 eV. A description of the technique used to obtain cross sections σ from photoemission measurements is provided, and a phenomenological discussion of the strong dependence of σ on the distortion of the initial-state *d* wave function in the solid environment with respect to the atomic case and in solid-state compounds with respect to pure metals is proposed. A strong reflection of the chemistry involving the *d* states on the photoionization probability is found, in particular, at the Cooper minimum. The use of photoemission at the Cooper minimum to study interfaces and compounds involving 4*d* and 5*d* states is discussed with the support of data relevant to commonly investigated systems, as well as an application to a less-studied refractory-metal-Si interface, namely, Mo/Si. (44 refs.)

120220 Characterization of thin Nb_3Sn diffusion layers on Nb (110): low-energy electron-diffraction and photoemission studies. R.J.Smith, A.Ghosh (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA).
Phys. Rev. B (USA), vol.28, no.6, p.3043-8 (15 Sept. 1983).
The authors have carried out low-energy electron-diffraction and ultraviolet photoemission spectroscopy studies of the surface structures formed by annealing Sn overlayers deposited on Nb (110) substrates at room temperature. In addition to the usual ring patterns observed by electron diffraction, they observe a preferred azimuthal orientation with Nb_3Sn [100] parallel to Nb [111] in the surface plane. The photoemission results show three regimes of Sn coverage extending from submonolayer Sn structures to the limit of thick islands of Sn, the latter being a prerequisite to forming the *A*15, Nb_3Sn structure. The contribution of the Sn 4*p* states to the electronic structure is followed as a function of Sn coverage. The evolution of the photoemission spectra as a function of sample annealing shows the trend through the *A*15 structure to the relatively inert $p(1\times1)$ phase of Sn on Nb. (14 refs.)

120221 Investigation of the electronic band structure of gold by means of spin-polarized photoelectrons. G.Borstel, M.Wohlecke (Fachbereich Phys., Univ. Osnabruck, Osnabruck, Germany).
Phys. Rev. B (USA), vol.28, no.6, p.3153-9 (15 Sept. 1983).
The light-induced spin polarization of photoelectrons from Au (111) and Au (111)+K is calculated within a spin-dependent three-step model of photoemission. The comparison of experimental and theoretical data for several different values of the work function Φ shows that one may obtain a satisfactory agreement between theory and experiment for all Φ, if one assumes an upshift in energy by 1.1-1.5 eV for low-lying unoccupied relativistic augmented-plane-wave bands. (25 refs.)

120222 Spin-density calculations for core-electron photoemission and Auger electron line shapes, X-ray-edge exponents, and solid-state shifts. T.T.Rantala (Dept. of Phys., Univ. of Oulu, Oulu, Finland).
Phys. Rev. B (USA), vol.28, no.6, p.3182-92 (15 Sept. 1983).
Spin-polarized density-functional conduction-electron screening calculations for core ionization and Auger transition for elements Li, Be, Na, Mg, Al, and Ca are performed. The screening is described by conduction-electron scattering phase shifts obtained from selfconsistent-field ab initio calculations. Both spins are treated separately in order to study the spin-polarization effects. The core-electron states are resolved by a Hartree-Fock-Slater method, which makes it possible to apply the same local-density exchange and correlation approximation to all electrons, including the conduction electrons. X-ray-edge exponents and X-ray photoelectron (XPS) line singularity indices are extracted from the phase shifts. Auger line singularity indices are also evaluated. In the case of Na, Mg, and Al metals the results agree with those of the previous spin-symmetric calculations and experimental values. The screening of Li and Be is, however, strongly spin-polarized, which both increases the singularity index and decreases the edge exponents. This partly explains the broad *K* edge of Li. The spin-polarized method seems to be necessary to describe the peculiar conduction-electron response to the core hole in Ca. The screening in this case is localized in energy, totally spin polarized, and of *d*-electron type. This should cause very broad X-ray edges and the most asymmetric XPS and Auger lines. By performing the corresponding free-atom calculations with the same method, the solid-state shifts (extra-atomic energies) for the photoelectron energies (binding energies) and Auger electron energies are obtained. The density-functional results agree better with the experiments than the results of the excitonic model or excited-atom model, for example. In the case of Ca the shift values are exceptionally large due to the localized *d*-electron screening. (49 refs.)

120223 Vacancy effects in the X-ray photoelectron spectra of TiN_x. L.Porte (Lab. de Phys.-Chimie Minerale, Univ. de Lyon I, Villeurbanne, France), L.Roux, J.Hanus.
Phys. Rev. B (USA), vol.28, no.6, p.3214-24 (15 Sept. 1983).
The electronic structures of titanium nitrides TiN_x have been investigated by X-ray photoelectron spectroscopy over the entire composition range of the rocksalt structure ($0.5\lesssim x\lesssim1$). The valence-region spectrum of stoichiometric TiN is consistent with results of band-structure calculations. The filling of a

defect state at about 2-eV binding energy with decreasing x is explicitly demonstrated. Experimental results are compared with different models for calculation of the electronic structure of anion-deficient rocksalt transition-metal compounds. Variation of the core-level binding energies indicates a decrease of the ionicity in TiN_x with decreasing x. The Ti $2p$ satellite structure found for nearly stoichiometric samples is discussed in terms of screening of the core hole by the conduction electrons. (55 refs.)

120224 Photoelectron emission and reflection in dynamic scattering of an almost parallel X-ray beam. M.V.Kruglov, E.A.Sozontov, I.K.Solomin.
Sov. Phys.-Solid State (USA), vol.25, no.3, p.372-4 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.653-7 (March 1983). [received: Oct. 1983]
The angular dependences of photoelectron emission and reflection were measured and calculated for a low-divergence beam diffracted by strongly asymmetric monochromators. Use was made of K_a radiation emitted by Cu and V targets. A strong enhancement of the anomalous change in photoelectron emission was observed. An analysis was made of the influence of a small but finite beam divergence on the measurements. The calculated and experimental results were in satisfactory agreement with the reasons for the residual discrepancies between them were considered. A comparison was made of the relative usefulness of two- and three-crystal configurations in the determination of the angular dependences of photoelectron emission. (20 refs.)

120225 The influence of local perturbation on the electron density of sodium-tungsten bronzes. R.V.Vedrinskii, E.V.Vinnikov, S.A.Prosandeev, V.P.Sachenko.
Ukr. Fiz. Zh. (USSR), vol.28, no.9, p.1408-13 (Sept. 1983). In Russian.
Photoelectron spectra of 4f core shell of W in Na_xWO_3 bronzes have been studied by Green's function method. For the ReO_3 structure electron Green's function has been obtained and applied in calculations using the Slater-Koster formalism. Results show that interpretation of $4f$ PES of W in terms of 'shape-up' satellites is not correct. (11 refs.)

Characterization of polypyrrole .... See Entry 118914

Semiempirical studies of core electron binding energies. II. SCC-MO calculations for uracil and its derivatives .... See Entry 118952

Chemistry and characterization of group V transition metal trichalcogenides .... See Entry 118982

New one-dimensional Vb transition metal tetrachalcogenides structural and transport properties .... See Entry 118984

Interaction of thin layers of Al and Ge with cleaved (Hg,Cd)Te surfaces .... See Entry 119279

A study of SO_2 adsorption on CaO (100) surfaces using X-ray photoelectron spectroscopy .... See Entry 119339

Intrinsic defects of TiO_2 (110): Interaction with chemisorbed O_2, H_2, CO, and CO_2 .... See Entry 119347

Compound formation and bonding configuration at the Si-Cu interface .... See Entry 119356

Local-density−functional approach to all-trans-polyacetylene .... See Entry 119396

Spectral studies on the electronic structure of polyacetylene . See Entry 119408

Split-off narrow d-band states above E_F in transition-metal alloys .... See Entry 119421

Experimental band structure of cadmium sulfide .... See Entry 119431

Site inequivalence in $Fe_{1+x}Nb_{3-x}Se_{10}$ .... See Entry 119432

Ionic limit in graphite-fluoroarsenate intercalation compounds .... See Entry 119538

Effects of vacuum annealing on the electronic properties of cleaved GaAs .... See Entry 119680

Interaction of CO and N_2 with the Cu (111) surface .... See Entry 119685

XPS studies on thermal switching in thick film Al-VP glass-Al structure .... See Entry 119715

Correlation effects in band ferromagnets as detected by energy-and angle-resolved spin-polarized photoemission: Ni(110) .... See Entry 119804

K-shell excitation of D_2O and H_2O ice. Photoion and photoelectron yields .... See Entry 120183

Modification of the surface due to ion bombardment: an XPS study .... See Entry 120204

Study of cleaved, oxidized, and heat-treated CdTe surfaces ... See Entry 120461

Initial stages of oxide formation on HgCdTe exposed to activated oxygen .... See Entry 120464

Applications of AES and XPS to characterization of aluminium and its compounds .... See Entry 120696

79.70 FIELD EMISSION AND FIELD IONIZATION

120226 Mechanism for explosive emission. A.M.Martsinovskii, V.G.Yur'ev (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.565-6 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR)*, vol.8, no.21-22, p.1312-16 (Nov. 1982). [received: Sept. 1983]
The rapid heating of a microscopic fine tip by a field-emission current results in the explosion of the tip and the formation of a cathode burst. As the metal converts into plasma, the emission of the cathode increases sharply (by one or two orders of magnitude); the process has accordingly come to be regarded as a particular type of emission: 'explosive electron emission'. Different opinions have been expressed regarding the nature of the electron emission from a fine tip into a cathode burst and regarding the kinetics of the evolution of this burst, but each interpretation runs into a difficulty of one sort or another in explaining the events which accompany explosive emission. The authors propose a new approach which they believe makes it possible to eliminate some of these difficulties. (17 refs.)

An aluminum liquid metal ion source with prolonged lifetime using a sintered boride emitter .... See Entry 117277

79.75 EXOELECTRON EMISSION

120227 Exoemission method for detection of an insulating layer on the surface of a ferroelectric. G.I.Rozenman, V.I.Pechorskii (Lenin Komsomol Ural Inst. of Timber Technol., Sverdlovsk, USSR).
Sov. Phys.-Solid State (USA), vol.25, no.3, p.510-11 (March 1983). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.25, no.3, p.888-90 (March 1983). [received: Oct. 1983]
The authors have determined the density of the emission current j, the maximum electron energy ϵ_m, the angular distribution of electrons $j(\phi)$, the sign of the charge of the emitting surface, and the dependence of j on the field E generated by the pyroelectric or the piezoelectric effect. They studied single-domain $LiNbO_3$ single crystals. The integrated electron flux was determined using a secondary-electron multiplier. The value of ϵ_m was determined by the familiar method of absorption in thin foils. (8 refs.)

80.00 CROSS-DISCIPLINARY PHYSICS AND RELATED AREAS OF SCIENCE AND TECHNOLOGY

81.00 MATERIALS SCIENCE

81.10 METHODS OF CRYSTAL GROWTH AND PURIFICATION

(for physics of crystal growth, see 61.50C; for epitaxial growth methods, see 81.15)

120228 Fabrication technologies of semiconductor materials. J.Piqueras.
Mundo Electron. (Spain), no.132, p.43-51 (Oct. 1983). In Spanish.
The author discusses semiconductor crystal growth techniques by first considering traditional bulk crystal growth methods and then describing the most significant techniques of epitaxial growth. Finally, some present and future trends are discussed. (10 refs.)

Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride .... See Entry 116917

Solar cells−a technology assessment .... See Entry 120744

81.10B Growth from vapour

120229 Growth and characterization of n-WS_2 and niobium-doped p-WS_2 single crystals. J.Baglio, E.Kamieniecki, N.DeCola, C.Struck (GTE Labs. Inc., Waltham, MA, USA), J.Marzik, K.Dwight, A.Wold.
J. Solid State Chem. (USA), vol.49, no.2, p.166-79 (Sept. 1983).
Single crystals of n- and p-WS_2 were obtained by chemical vapor transport using chlorine and bromine as transporting agents. The best niobium-doped WS_2 crystals were obtained when the concentration of the charge (formulated $(1-x)WS_2.(x)NbS_2$) was $\simeq$37 mg charge/ml of tube, and $x=0.01$ to 0.03. A thermodynamic analysis of the crystal growth process is consistent with the observed doping concentration and other properties of the crystals obtained by this process. The crystals grown are characterized by electrical transport and surface photovoltage measured capacitance techniques. (22 refs.)

120230 Vapour phase growth of arsenic chalcogenide crystals and their characterization. B.Ghosh, G.P.Kothiyal (Tech. Phys. Div., Bhabha Atomic Res. Centre, Bombay, India).
Prog. Cryst. Growth & Charact. (GB), vol.6, no.4, p.393-413 (1983).
The authors review the growth of arsenic chalcogenide crystals from vapour phase emphasizing the difficulties encountered for the growth of good quality crystals of suitable size. Structure of the grown crystals is mentioned briefly. Results of investigations on their optical, electrical and photoconductive properties is discussed and at times is compared with those of the glassy and amorphous materials for the sake of clarity. Future trends as regards the growth of mixed crystals and device fabrication is hinted at. (74 refs.)

81.10D Growth from solutions

120231 Interaction in the K_2O-Mn_2O_3-P_2H_2O system at 140-400°C. L.S.Guzeeva, A.V.Lavrov, I.V.Tananaev (N.S. Kurnakov Inst. of General & Inorganic Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1590-4 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1850 (Nov. 1982).
When manganese dioxide was heated with phosphoric acid and potassium carbonate (or nitrate) at 140-400°C, the following mixed condensed phosphates of trivalent manganese and potassium were obtained: $KMn(H_2P_2O_7)_2$, $KMnHP_3O_{10}$, $KMnHP_2O_7$; the cyclotriphosphate of divalent manganese $KMnP_3O_9$ was also obtained. The isolated compounds were characterized by chemical, X-ray crystallographic, IR-spectroscopic, and thermogravimetric methods. (4 refs.)

120232 Mixed crystals based on antimony niobate in the Sb_2O_3-Nb_2O_5-Sb_2O_5-KHF_2-H_2O_2-H_2O system. S.Yu.Stefanovich, V.I.Popolitov, A.V.Astaf'ev, F.Kh.Chibirova, S.I.Reiman, Yu.N.Venevtsev (L.Ya. Karpov Sci.-Res. Physicochem. Inst., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1607-12 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1869-74 (Nov. 1982).
The conditions of crystallization in the system Sb_2O_3-Nb_2O_5-Sb_2O_5-KHF_2-H_2O_2-H_2O were studied for various values of the redox potential. Mixed crystals of $SbNbO_4$-Sb^{5+} with the structure of ferroelectric antimony niobate were obtained, which must be regarded as solid solutions of substitution based on the phases $SbNbO_4$ and α-$SbSbO_4$. The composition of the specimens is represented by the equation $Sb(Sb_xNb_{1-x})O_4$, where x=0, 0.08, 0.14, 0.26. The dielectric properties of $Sb(Sb_xNb_{1-x})O_4$ crystals are characteristics of a ferroelectric and found to depend on the content of pentavalent antimony. (7 refs.)

120233 Effects of solvents and cell design for crystal growth of organic metals. H.Anzai, T.Moriya, K.Nozaki (Electrotech. Lab., Ibaraki, Japan), T.Ukachi, G.Saito.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1195-9 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Crystals of TTF- and TMTTF-TCNQ have been obtained by the diffusion method. The amount of the used reagents and the character of the used solvents have determined the size and shape of the crystals. Crystals of $(TMTTF)_2BF_4$ and $(TMTSF)_2ClO_4$ have been synthesized by the electrochemical method. Several types of the growing cell have been tested, and spectroscopic and chemical analysis for the crystal-growth mechanism have been presented. (3 refs.)

120234 Electrocrystallization of the complexes of tetrathiatetracene and synthesis of tetraselenaanthracene. T.Nogami, S.Ohnishi, H.Tanaka, H.Mikawa (Dept. of Appl. Chem., Osaka Univ., Osaka, Japan).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1253-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Electrocrystallization of 5,6,11,12-tetrathiatetracene gave several metallic conductive single crystals. A new donor molecule, 1,4,9,10-tetraselenaanthracene, was synthesized. (9 refs.)

120235 Quality of ADP crystals formed by rapid growth from a point-like seed. A.T.Amandosov, Z.S.Pashina, L.N.Rashkovich (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.271-2 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.469-70 (March 1983). [received: Oct. 1983]
A seed of $\sim 5 \times 5 \times 5$ mm dimensions was used to grow ADP crystals of $\sim 10 \times 10 \times 10$ cm size by crystallization from a solution at a rate 10-20 times higher than usual. The anomalous biaxiality of the crystals did not exceed $\sim 20'$, which was of the same order of magnitude as the value reported for good-quality crystals prepared by slow growth. A growth rate of ~ 1 cm/day should make it possible to prepare nonlinear crystals with large cross sections of the kind needed in laser thermonuclear fusion research. (2 refs.)

120236 An experiment of growing of crystals with optical transducer properties in gel and the investigation of those by X-ray method. Yu.E.Smirnov, G.A.Volkova, Yu.M.Smirnov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.115-16 (Aug. 1983). In Russian.
$C_4H_4CaO_6.4H_2O$, $NiSO_4.6H_2O$, $C_2H_4N_2H_4.H_2SO_4$ and $C_2H_4N_2H_4.2H_3PO_4$ crystals grown in gel were investigated by an X-ray method. Space group and lattice constants were determined for all crystals. (7 refs.)

81.10F Growth from melts

120237 Growth and investigation of $Ca_3(VO_4)_2$. O.K.Buznyakova, L.I.Ivleva, Yu.S.Kuz'minova, V.V.Osiko (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1612-15 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1875-8 (Nov. 1982).
Large, optically homogeneous monocrystals of calcium orthovanadate were obtained by the Czochralski method from the melt. The optical and dielectric characteristics, and the domain structure were investigated. (4 refs.)

120238 Substitution reactions in solvent-ferrite systems and acid-base properties of the components. L.M.Viting, A.F.Isaev (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1625-8 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1890-2 (Nov. 1982).
The acid-base properties of the components determine the nature of exchange processes in ionic melts. The acidity parameters of the solvent necessary for the synthesis of homogeneous single crystals of mixed ferrites were determined. (7 refs.)

120239 Computer controlled growth of GaP by LEC technique. S.Washizuka, J.Ushizawa, Y.Kokubun, M.Watanabe, T.Fukuda (Toshiba Res. & Dev. Center, Kawasaki, Japan).
Oyo Buturi (Japan), vol.52, no.6, p.515-21 (June 1983). In Japanese.
An automatic computer controlled LEC growth technique for GaP single crystal has been developed. Large diameter $\langle 111 \rangle$ and $\langle 100 \rangle$ oriented GaP crystals of up to 62 mm could be successfully grown by closed-loop control using crystal weighing. In the new automated technique, many growth parameters were measured during growth. The measurements were fed into the computer and processed in real time. The main responsibilities assumed by the computer are: (1) precise correction of weight signal, (2) calculation of phase advance, (3) addition of second differential signals on weight deviation to the diameter control loop, (4) optimum adjustment of growth parameters. (17 refs.)

120240 Crystal growth from melts of high viscosity. J.Liebertz (Inst. fur Kristallographie, Univ. zu Koln, Koln, Germany).
Prog. Cryst. Growth & Charact. (GB), vol.6, no.4, p.361-9 (1983).
The growing of large single crystals from glass forming melts is not so much a problem of principle, but rather a question of time and endurance, because of the small mobility of the atoms in such viscous melts. Therefore, the growth rates are unusually small resulting in extended growth periods. For the experimental procedure a top-seeding similar to the Czochralski or Nacken-Kyropoulos technique is most suitable. In consequence, such an experiment can be employed. The preparation of the seed crystals will be a difficult task needing several consecutive cycles of enlarging the grains, until a monocrystalline seed results. The compounds so far investigated are $Li_2B_4O_7$, PbB_4O_7, BaB_4O_7, $Bi_3B_5O_{12}$, BiB_3O_6, $LiBGeO_4$, Zn_3BPO_7, and $KMgP_3O_9$. In most cases crystals with optically clear parts of at least 1 cm^3 have been obtained. (29 refs.)

A new delafossite-type compound $CuYO_2$. I. Synthesis and characterization ....See Entry 118980

81.10H Zone melting and zone refining

120241 Stability of a vertical melt zone. N.E.Mokrousov, A.M.Pronin, D.A.Yas'kov (V.I. Ul'yanov Lenin Leningrad Electrical Engng. Inst., Leningrad, USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1649-51 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1913-15 (Nov. 1982).
The crucibleless zone melting (CZM) technique occupies a key place in the technology of preparation of cubic single crystals of semiconductors. Its advantage over the crucible technique of single-crystal growing from melts is well known. A major drawback of the CZM technique is the limitation of the diameter of the ingot produced. The structural perfection of the crystal grown can be achieved by a flat crystallization front, for which the height of the melt zone should be close to the ingot diameter. A refined expression was derived for the maximum height of the stable melt zone. (6 refs.)

120242 Zone melting purification of alkali halides. V.Yu.Shishkin, V.S.Mityaev (Electrochem. Inst., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1653-4 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1917-18 (Nov. 1982).
All the alkali halides apart from NaF were examined. The grades of the salts were special-purity and chemically pure. The performance in the purification was checked by observing the molten zone during the process along with visual examination of the purified salts and measurement of the pH of the aqueous solution (samples were taken from the start, middle, and end of the boat). Observation of the molten zone showed that in all cases there were impurities insoluble in the liquid phase, which were transported fairly vigorously by convection currents as small clumps of black or white color. The insoluble particles concentrated in the liquid phase and accumulated at the end of the boat. After purification, the salt was a monolithic casting in the shape of the boat, most of which (about 4/5) was completely colorless and transparent with occasional cracks. (5 refs.)

81.15 METHODS OF THIN FILM DEPOSITION

(inc. epitaxial growth methods; see also 68.55 Thin film growth, structure, and epitaxy)

120243 One method of solving the coating problem. I.V.Serqienko, V.O.Roshchin.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.71-3 (1983). In Ukrainian.
A method is suggested for the exact solution of the problem of coating. Its convergence is established and results of a computer experiment presented. (2 refs.)

120244 Recent progress on LADA growth of HgCdTe and CdTe epitaxial layers. J.T.Cheung (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1604-7 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
Laser assisted deposition (LADA) has been used to deposit eptiaxial $Hg_{0.7}Cd_{0.3}Te$ layers on CdTe substrates and CdTe layers on GaAs substrates. As-grown $Hg_{0.7}Cd_{0.3}Te$ layers are *n*-type and can be converted to *p*-type by annealing. Implanted n^+/p photodiodes have been demonstrated. Heteroepitaxial (111)CdTe/(110) GaAs layers were characterized by X-ray diffraction, UV reflectance, photoluminescence and transmission electron microscopy (TEM). Results indicate good crystallinity with 10^5 cm^{-2} dislocation densities beyond a few microns from the CdTe/GaAs interface. (9 refs.)

A review of laser beam applications for processing silicon .....See Entry 119059

Fabrication technologies of semiconductor materials ....See Entry 120228

Phase transitions and thermoluminescence of a plasma-sprayed zinc silicate phosphor ....See Entry 120326

81.15C Deposition by cathodic sputtering

120245 The reactive sputtering of tantalum oxide: compositional uniformity, phases, and transport mechanisms. T.M.Reith (General Products Div., IBM Corp., Tucson, AZ, USA), P.J.Ficalora.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1362-9 (1983).
Reactive sputtering has been investigated by a number of workers, but no clear, generalized picture of the method or the phenomena involved has emerged. It is shown that the variation observed in the partial pressure of O_2 during both reactive and nonreactive Ta depositions is a sensitive measure of reactive surface activity in the plasma. A detailed examination of the O_2 behavior is made as the degree of activity of either target or substrate is systematically changed. A correlation is made between observed O_2 partial pressure variations and resulting compositional variations of the collected films using Auger electron spectroscopy, Auger sputter profiling, and transmission electron microscopy. Most importantly, the authors describe the reactive sputtering of Ta in O_2 in terms of two inverse reactions at two reactive surfaces; a dissociative reaction proceeds at the target while its inverse proceeds at the substrate. A generalized process in which a metal oxide dissociates to a less-stable suboxide at the target, transfers to the substrate as the suboxide, and recombines to form the original target compound, is suggested for the reactive sputtering of any metal oxide which exhibits preferential sputtering effects. (26 refs.)

120246 Transparent conducting zinc oxide and indium-tin oxide films prepared by modified reactive planar magnetron sputtering. S.Maniv, C.J.Miner, W.D.Westwood (Bell-Northern Res., Ottawa, Ontario, Canada).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1370-5 (1983).
Transparent conducting layers for liquid crystal displays and plastic substrates must be deposited without significant heating. A planar magnetron sputtering process which provides a suitable combination of resistivity and transparency on unheated substrates has been developed. Transparent conducting films of ZnO and indium tin oxide (ITO) have been deposited by sputtering Zn and $In_{0.9}Sn_{0.1}$ targets in a planar magnetron system modified to introduce oxygen near the substrate and to reduce the conductance for oxygen to the target. As the oxygen flow rate f_2 increased, the DC voltage V_a, required to maintain constant sputtering current, first increased and then decreased rapidly as the critical flow rate f_{2c}, at which the target oxidizes, is approached. In the ZnO case, V_a, had a maximum value of 525 V and was 355 V after the target oxidized; transparent conducting films were obtained at 435 V but the best films were obtained by activating an RF discharge close to the substrate to increase the oxidation rate. These polycrystalline films had a transmittance of 80% and a resistivity of 0.03 Ω cm but their chemical stability was too poor for useful application. In the ITO case, the RF discharge was necessary to obtain transparent conducting films. Even at $f_2/f_{2c}=0.94$, films were opaque

in the absence of this extra oxidation mechanism. Films with a transmittance of 79% and a resistivity of $1\times10^{-4}\Omega$ cm were obtained by coupling an RF power of 105 W to the substrate holder, with a substrate self-bias voltage less than 5 V, at $f_2/f_{2c}=0.77$. These films are amorphous and chemically stable. This sputtering process provides a maximum deposition rate of 48 nm/min on unheated substrates and is suitable for fabricating MIM-addressed liquid crystal displays. (17 refs.)

120247 Influence of the sputtering gas pressure on deposition profiles. G.Gonzalez-Diaz, I.Martil, F.Sanchez-Quesada, M.Rodriguez-Vidal (Dept. de Electricidad y Electronica, Facultad de Fisicas, Univ. Complutense, Madrid, Spain), A.Gras-Marti, J.A.Valles-Abarca.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1394-7 (1983).
Experimental thickness profiles of thin films deposited on substrates perpendicular to the target being sputtered show maxima whose position depends on the sputtering gas pressure. A simple model of particle slowing down in the transport stage accounts for this fact. The influence of diffusional transport on thin film profiles deposited on substrates both parallel and perpendicular to the target, can be estimated comparing experimental data with model predictions. (17 refs.)

120248 Radio-frequency sputtered indium tin oxide thin films. M.Russak, J.De Carlo (Res. & Dev. Center, Grumman Aerospace Corp., Bethpage, NY, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1563-4 (1983).
$In_{2-x}Sn_xO_{3-y}$ films are produced by RF sputtering. The films are heat treated in situ using the Ar sputtering plasma to heat the substrates. The structural properties are investigated by X-ray diffraction analysis. Electronic and optical properties are studied using measurements of resistivity, Hall coefficient, light transmission, and reflectivity. (19 refs.)

Preparation and properties of sputtered a-Si:H:F films ....See Entry 119376

Electrical properties of junctions between sputter deposited silicon films and monocrystalline silicon ....See Entry 119701

The properties of Cr-Si-O thin film resistors by DC conventional sputtering ....See Entry 119716

Highly doped amorphous silicon without hydrogen ....See Entry 119727

Mechanical behaviour of TiC film coated on molybdenum by magnetron sputtering ....See Entry 120507

81.15G Vacuum deposition

120249 Measurements of angular evaporation characteristics of sources. J.A.Dobrowolski, M.Ranger, R.L.Wilkinson (Div. of Phys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1403-8 (1983).
An apparatus is described for the rapid and reliable measurement of the angular evaporation characteristics of sources. It consists of a moving and a stationary quartz crystal evaporation rate monitor, and it can be operated at any chosen azimuth angle. The instrument has been used to demonstrate the effect of source design, rate of evaporation, external obstructions, and evaporant material on the angular evaporation characteristic of high rate, high capacity evaporation sources. (23 refs.)

120250 Simple evaporator for refractory metal thin film deposition in ultrahigh vacuum. J.R.Waldrop, R.W.Grant (Rockwell Internat., Microelectronics Res. & Dev. Center, Thousand Oaks, CA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1553-4 (1983).
Describes a relatively simple, compact, and low cost evaporator for refractory metals based on electron bombardment heating of a thin refractory metal wire source. The evaporator is UHV compatible (operates in the 10^{-9} Torr range or below), has a stable evaporation rate, gives contamination-free thin film deposits, and needs no external cooling. The evaporation method is based on the observation that most refractory metals have relatively high vapor pressures at temperatures reasonably below the melting point. (5 refs.)

120251 Latest developments in the growth of $Cd_xHg_{1-x}Te$ and CdTe-HgTe superlattices by molecular beam epitaxy. J.P.Faurie, A.Million, R.Boch, J.L.Tissot (Lab. Infrarouge, Leti/Ceng, Grenoble, France).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1593-7 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
The authors present here a general survey of their activity since 1981. They show that *n*- or *p*-type $Cd_xHg_{1-x}Te$ with low carrier concentration, high mobility and crystal perfection limited by the substrate itself can be grown by molecular beam epitaxy (MBE) between 180 and 210°C onto CdTe(111) and (100) orientation. They report for the first time the characteristics of a photovoltaic device processed on a *p*-type $Cd_xHg_{1-x}Te$ MBE layer which proves that this material can be grown by MBE with a detection device specification. They also give some information concerning 100 periods of 224 Å CdTe-HgTe superlattice previously reported. (9 refs.)

120252 Growth of low dislocation density CdTe films on hydroplaned CdTe substrates by molecular beam epitaxy. T.H.Myers, J.F.Schetzina (Dept. of Phys., North Carolina State Univ., Raleigh, NC, USA), T.J.Magee, R.D.Ormond.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1598-603 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
A systematic study of CdTe film growth by molecular beam epitaxy (MBE) on hydroplaned (111)A and (111)B CdTe substrates is discussed. Substrate preparation prior to growth involved chemical etching techniques, rather than sputtering in UHV, in order to maintain the integrity of the hydroplaned surface. A range of substrate temperature during growth was investigated. X-ray diffraction, UV reflection, and transmission electron diffraction measurements were employed to evaluate the structural quality of the CdTe films. Bright and dark field transmission electron microscopy was used to determine film dislocation densities. An entirely different film growth morphology was observed on the (111)A versus (111)B substrate surfaces for the range of temperatures and growth rate employed. Growth of high quality, low dislocation density, twin-free CdTe films was achieved on hydroplaned (111)A CdTe substrates at 250°C. (20 refs.)

Preparation of Pb-Bi film by alloy evaporation. II. Microstructure and morphology ....See Entry 119358

A technique using a Wheatstone bridge to study the minute differences in nucleation and growth of two metallic films ....See Entry 119359

Characterizaiton of eptiaxial films of CdTe and CdS grown by hot-walled epitaxy ....See Entry 119375

Investigation of persistent photoconductivity in Si-doped *n*-$Al_xGa_{1-x}As$ grown by molecular beam epitaxy ....See Entry 119643

A study on the purity and SIMS profiling of MOVPE-cadmium mercury telluride ....See Entry 119723

Phase composition of vacuum condensates in the Y_2O_3-ZrO_2 system ....See Entry 120315

81.15H Chemical vapour deposition

120253 CVD growth of silicon using higher-order silanes. D.C.Green, R.M.Plecenik, B.A.Scott, R.K.Tsui (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.3A, p.918-20 (Aug. 1983).
In the growth of epitaxial silicon using chemical vapor deposition (CVD), reduced growth temperatures and/or higher growth rates can minimize autodoping, interface variations, and the resulting degradation of device performance. (no refs.)

120254 Low pressure CVD process for micro and polycrystalline silicon. J.M.Blum, D.C.Green, B.S.Meyerson, B.A.Scott (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.3A, p.921-2 (Aug. 1983).
Micro and polycrystalline silicon thin films are prepared by low pressure chemical vapor deposition (LPCVD) processes in which the source gas is disilane (Si_2H_6). (no refs.)

120255 Simple method for preparing hydrogenated amorphous silicon films by chemical vapor deposition at atmospheric pressure. F.B.Ellis,Jr., R.G.Gordon (Dept. of Chem., Harvard Univ., Cambridge, MA, USA).
J. Appl. Phys. (USA), vol.54, no.9, p.5381-4 (Sept. 1983).
An inexpensive one-step method is presented for fabricating hydrogenated amorphous silicon (*a*-Si:H) films with good photovoltaic properties using chemical vapor deposition (CVD) from a mixture of polysilanes, Si_nH_{2n+2}, in hydrogen at atmospheric pressure. This gas mixture is generated by a simple chemical reaction and used immediately in the CVD process. Thus, the highly flammable polysilanes need not be handled, distilled, stored, or transported. The conditions necessary for high (about 10%) hydrogen incorporation are explained. The method requires no expensive vacuum or electrical equipment and permits very high deposition rates (50-100 Å/s). It is shown that the growth rate of the film is determined by the gas-phase chemistry and not the surface chemistry. In addition, a new, safe, and economical technique for phosphorus doping is described. (13 refs.)

120256 Thermodynamic calculations for the chemical vapor deposition of silicon nitride. A.I.Kingon, L.J.Lutz, R.F.Davis (Dept. of Materials Engng., North Carolina State Univ., Raleigh, NC, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.551-8 (Aug. 1983).
The importance of silicon nitride (Si_3N_4) prepared by the chemical vapor deposition (CVD) technique is discussed briefly. A computer code was used to calculate CVD phase diagrams useful for the preparation of this material. Theoretical deposition efficiencies and gaseous phase compositions are also reported. The reactants include NH_3/SiH_4, NH_3/SiH_2Cl_2, $NH_3/SiCl_4$, and NH_3/SiF_4. The effect of N_2, H_2, and Ar additions, as well as the system pressure, are evaluated. The results are compared with experimental data from the literature. (73 refs.)

120257 Thermodynamic calculations for the chemical vapor deposition of silicon carbide. A.I.Kingon, L.J.Lutz, P.Liaw, R.F.Davis (Dept. of Materials Engng., North Carolina State Univ., Raleigh, NC, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.558-66 (Aug. 1983).
A computer code, SOLGASMIX-PV, was used to calculate CVD phase diagrams useful for the preparation of silicon carbide from commonly used precursors. The results show that in order to prepare single-phase β-SiC it is necessary to closely control thermodynamic parameters such as pressure, temperature, and the concentrations of the precursor and carrier gases. The system Si-C-H is substantially different from that of Si-C-H-Cl, the latter being more complex, with single-phase β-SiC occurring under conditions very different from those of the former. The calculated CVD phase diagrams are compared with calculated and experimental data from the literature. The fundamental importance of a thermodynamic equilibrium description of the CVD system is emphasized. (34 refs.)

120258 High-purity InP grown by hydride VPE technique with impurity gettering by indium source and oxygen. A.Usui, H.Watanabe (Fundamental Res. Labs., NEC Corp., Kawasaki, Japan).
J. Electron. Mater. (USA), vol.12, no.5, p.891-902 (Sept. 1983).
Purification methods for vapor-grown InP layers have been investigated for the hydride ($In/HCl/PH_3/H_2$) process. The carrier concentration of non-doped InP layers was found to be decreased with a commensurate increase in mobility by increasing the indium source temperature and by introducing a small amount (a few p.p.m.) of oxygen into the growth region. At 910°C of In source temperature with 1.2 p.p.m. oxygen, a 77K mobility as high as 40000 cm^2/v.sec (3480 cm^2/v.sec at 300K) with a carrier concentration as low as 5×10^{14} cm^{-3} (8×10^{14} cm^{-3} at 300K) was obtained. Photoluminescence efficiency was also found to be improved by the above-mentioned two methods. Mass spectroscopy analysis of used In metal showed a few p.p.m. impurity contamination, such as Sn, Fe and Cu, which were hardly detected in raw 6′9-purity In metal before the growth experiment. These results indicate that the In source has a gettering effect for impurities in input gases, mainly HCl from a cylinder, and the effect was enhanced by increasing the In source temperature. The oxygen may play a role in the conversion to non-volatile oxides of residual impurities and hence a reduction in the impurity incorporation. (10 refs.)

120259 Thin film studies of oxides by the organometallic-CVD technique. H.Prakash (Inorganic Chem. Div., Nat. Chem. Lab., Poona, India).
Prog. Cryst. Growth & Charact. (GB), vol.6, no.4, p.371-91 (1983).
The organometallic-CVD technique is reviewed for the growth of thin films of binary oxides, for example, of SiO_2, GeO_2, SnO_2, TiO_2, ZrO_2, HfO_2, Al_2O_3, Ta_2O_5, Nb_2O_5, Fe_2O_3 and ZnO. Growth methods, film characterizations, film properties and their potential device applications are reported. (61 refs.)

120260 A linear analysis of chemical vapour deposition processes for micro-electronics applications. I. Diffusive gas transport. H.Arnold.
Wiss. Z. Tech. Hochsch. Ilmenau (Germany), vol.29, no.3, p.117-24 (1983). In German.
Analyses vapour diffusion doping methods for the production of silicon semiconductor devices, and models the deposition system as a resistance network, with reference to thermal diffusion effects. (10 refs.) *G.M.E.*

120261 A linear analysis of chemical vapour deposition processes for micro-electronics applications. II. Surface effects. H.Arnold.
Wiss. Z. Tech. Hochsch. Ilmenau (Germany), vol.29, no.3, p.125-32 (1983). In German.
For pt.I see ibid., vol.29, no.3, p.117 (1983). A linear analysis is proposed for thermodynamic dissociation effects for various diffusion current densities. This is applied to hydrides SiH_r where r is between 1 and 4. The problems of simultaneous parallel reactions are mentioned and conclusions are drawn on

the applicability of linear models for current density, with special reference to hydride processes using a hydrogen carrier. Finally, nonlinear effects in chloride processes are considered. (11 refs.) *G.M.E.*

Optically pumped laser operation of InGaAsP/InGaP double heterostructures grown by metalorganic chemical vapor deposition ....See Entry 118138

Solar cells — a technology assessment ....See Entry 120744

81.15J Ion plating and other vapour deposition

120262 A deposition aid for matrix isolation studies. W.E.Klotzbucher (Max Planck Inst. fur Strahlenchem., Mulheim a.d. Ruhr, Germany).
Cryogenics (GB), vol.23, no.10, p.554-6 (Oct. 1983).
An alternative to the usual matrix isolation deposition technique has been developed whereby the deposition rate of any material can be established by using a quartz crystal microbalance incorporated into the cryogenic sample holder. (15 refs.)

120263 Heavily boron doped crystalline silicon films by plasma technique. Y.Yoshida, Y.Onuma (Dept. of Electrical Engng., Shinshu Univ., Nagano, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1222 (July 1983).
Plasma decomposition was performed in a horizontal quartz tube with an inner diameter of 38 mm at various substrate temperatures from 450°C to 650°C. X-ray diffractometer scans and RHEED patterns of (a) undoped and (b) heavily boron doped silicon films about 10 μm thick deposited at the various substrate temperatures are shown. Heavy boron doping causes the growth of crystallites with preferred orientation, possibly due to catalysis by boron. (4 refs.)

120264 Importance of chain reactions in the plasma deposition of hydrogenated amorphous silicon. I.Haller (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1376-82 (1983).
Insight on the deposition mechanism of hydrogenated amorphous silicon (*a*-Si:H) can be gained by inspecting the consumption rates of SiH_4 by various species in the plasma since essentially all the silicon in the silane consumed is incorporated in the solid. Chemical chain reactions eliminating H_2 are thermodynamically allowed as the replacement of two Si-H bonds with H-H and Si-Si bonds is thermoneutral or exothermic. In the case where the chain carriers are positive ions, the chain reaction is known to proceed at collisional rates. The relative rate of SiH_4 removal by electron impact induced fragmentation can be estimated for various plasma conditions by making appropriate assumptions for the distribution function, mean electron energy, and fragmentation cross section. It is found that under most conditions used for the deposition of *a*-Si-H, the species arising from chain reactions are more important in silicon transport than fragments directly formed in electron impact. (40 refs.)

120265 Process for depositing thin, continuous metal films. E.I.Alessandrini, C.R.Guarnieri (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.3A, p.925-6 (Aug. 1983).
Using alow energy, low intensity argon ion beam to bombard (1) the substrate before deposition and (2) the growing film during deposition, it has been possible to deposit continuous gold films at a thickness of 5.6 nm. (no refs.)

VPE-grown 1.3 μm InGaAsP/InP double-channel planar buried-heterostructure laser diode with LPE-burying layers ....See Entry 118160

Development of optical fibres by the VAD method ....See Entry 118296

Use of electric probes in silane radio frequency discharges ...See Entry 118785

Ion plated transparent conductive films ....See Entry 119732

81.15L Deposition from liquid phases (melts and solutions)

120266 Horizontal slider LPE of (HgCd)Te. R.A.Wood, R.J.Hager (Honeywell Corporate Technol. Center, Bloomington, MN, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1608-11 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
The authors report the epitaxial growth of single and double layers of $Hg_{1-x}Cd_xTe$ on 2×3 cm single-crystal CdTe substrates, using liquid phase epitaxy (LPE) from tellurium solution in an atmospheric pressure horizontal slider apparatus. The layers are found to be extremely uniform in composition (x) across individual layer areas and in layer-to-layer reproducibility (standard deviation 0.002). They report their observations of the morphological, compositional and crystalline quality of the layers, and measurements of the electrical parameters of the layers. (9 refs.)

120267 Surface controlled crystallization of poly(tetramethylene terephthalate). H.Ghavamikia, S.E.Rickert (Dept. of Macromolecular Sci., Case Western Reserve Univ., Cleveland, OH, USA).
J. Mater. Sci. (GB), vol.18, no.10, p.2969-75 (Oct. 1983).
Epitaxial crystallization of poly(tetramethylene terephthalate) from dimethyl phthalate solution on alkali halide crystals has been studied using electron microscopy and electron diffraction techniques. Rod-like crystals oriented in the ⟨110⟩ directions of the substrate were found to form at short crystallization times. At longer times, however, lamella-like crystals, which were nucleated at the sides of the rod-like crystals, grew in directions dictated by the substrate. Besides the normal bidirectional orientations induced by the substrate, the polymer crystals showed twinning which was found to be due to the triclinic lattice structure of the polymer. (12 refs.)

120268 A process for producing micropattern by electroless nickel plating. S.Mizushima (Dept. of Mech. Engng., Nat. Defense, Acad., Yokosuka, Japan), Y.Kimura.
Sci. & Eng. Rep. Natl. Def. Acad. (Jpn.) (Japan), vol.20, no.4, p.335-42 (Dec. 1982). In Japanese. [received: Sept. 1983]
An electroless nickel deposit on glass has been studied for use as a micropattern. For this purpose, metal to glass adhesion and the surface smoothness are substantially important. The good adhesion strength between the glass and the deposited nickel is obtained by immersing the glass in a conventional chromic-sulfuric acid etching solution and by treating with sodium hydroxide solution. A high-level nickel deposit was also obtained by using sodium citrate or ammonium citrate as a condition complexing agent in the electroless nickel bath. The optimum etching composition and operation for the production of micropatterns were found to be 8% HNO_3–70% H_3PO_4–22% H_2O, at 25°C for an etching time of 5-7 min. (9 refs.)

120269 Material transfer with vertical electrodes. P.Kutzschbach, H.Liebscher (Tech. Hochschule Ilmenau, Ilmenau, Germany).
Wiss. Z. Tech. Hochsch. Ilmenau (Germany), vol.29, no.3, p.85-94 (1983). In German.
Describes experiments on the effects of diffusion, migration and convection on the rate of material transfer in electroplating. Diffusion limits are calculated, and work with injection of argon gas jets, and with rotating electrodes, is outlined. It is shown that material transfer increases with rotation rate up to 6000 revolutions per minute. The base electrode was made of titanium, the electrolyte was ammonium iron sulphate and a lead anode was used. (3 refs.) *G.M.E.*

VPE-grown 1.3 μm InGaAsP/InP double-channel planar buried-heterostructure laser diode with LPE-burying layers ....See Entry 118160

Selective meltbacked substrate inner-stripe AlGaAs/GaAs lasers operated under room temperature CW condition ....See Entry 118161

Some aspects of Li behavior in ion implanted HgCdTe ....See Entry 119052

Electronic and ionic transport properties of electrodeposited polypyrrole films . ...See Entry 119607

Comparative studies of mercury cadmium telluride single crystal and epitaxial ....See Entry 120023

Electroless nickelplating of molybdenum-containing nickel steels ....See Entry 120500

Chemical deposition of $Cd_{1-x}Hg_xS$ thin film electrodes for liquid-junction solar cells ....See Entry 120746

81.20 OTHER METHODS OF PREPARATION OF MATERIALS

120270 Intercalation of tetrathiafulvalene, tetrathiatetracene, and related molecules into iron oxychloride. B.A.Averill, S.M.Kauzlarich (Dept. of Chem., Univ. of Virginia, Charlottesville, VA, USA), M.R.Antonio.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1373-6 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Intercalation of tetrathiafulvalene (TTF), tetramethyltetrathiafulvalene (TMTTF), tetrathiatetracene (TTT), and tetrathianaphthalene (TTN) into FeOCl has resulted in a new series of low-dimensional compounds, with conductivities ca. 10^2-10^3 higher than that of FeOCl. (14 refs.)

$[H_3NCH_2CH_2NH_3]_{0.82}[Pt(C_2O_4)_2].2H_2O$ — a new partially oxidised bis(oxalato)platinate ....See Entry 119576

Synthesis and luminescent properties of solid solutions $Tb_xCe_{1-x}BO_3$ ....See Entry 120126

81.20E Powder techniques, compaction and sintering

Unit-cell parameters of titanium oxynitrides ....See Entry 118965

High coercive force 2-17-type $Sm_{1-x}Er_x(Co_{0.69}Fe_{0.22}Cu_{0.08}Zr_{0.02})_{7.22}$ magnets with a low temperature coefficient ....See Entry 119873

Ferroelectric properties of compounds with magnesium orthotellurate structure ....See Entry 119992

Sintering of submicron tungsten-based heavy alloys ....See Entry 120272

Effect of electrolysis time on the magnetic properties of fine iron powders ....See Entry 120275

Conditions of formation, structure, and magnetic properties of finely divided iron produced in the presence of ED-20 epoxide oligomer and oleic acid ....See Entry 120276

Sintering of tungsten-nickel-iron alloy powders ....See Entry 120277

Structure formation in magnetoabrasive materials from iron-carbon melts alloyed with carbide-forming elements ....See Entry 120278

A dense ceramic based on gadolinium-gallium garnet ....See Entry 120281

Preparation of $Bi_4Ti_3O_{12}$ powders in the presence of molten salt containing LiCl ....See Entry 120284

Mechanisms of densification during the hot pressing of calcium oxide and synthetic doloma ....See Entry 120286

Low temperature sintering of TiO_2 ....See Entry 120287

Effects of Cr_2O_3 additions on the sintering and mechanical properties of Al_2O_3 ....See Entry 120288

Effect of nature and chemical structure of water-soluble polymers on structure formation in the ferrite powder-water system and its properties ....See Entry 120289

Cold pressing of wurtzite boron nitride powders under high pressures ....See Entry 120290

Sintering of tin oxide ceramic with additives ....See Entry 120291

Microstructure of sintered mullite-zirconia composites ....See Entry 120293

Detection of thin intergranular cobalt layers in WC-Co composites by lattice imaging ....See Entry 120294

Phase fields and initial melting diagrams of the pseudoquaternary system UC-$MoC_{1-x}$$ZrC$-NbC ....See Entry 120312

Characterization of creep cavitation in sintered alumina by small-angle neutron scattering ....See Entry 120376

Resistance to deformation of pressed strips from granulated alloys ....See Entry 120386

High-temperature friction of alloys of the TiN_x-TiB_2 system ....See Entry 120449

Corrosion behaviour of hot-pressed austenitic stainless steel in H_2SO_4 solutions at room temperature ....See Entry 120488

81.20G Specific metals and alloys (compacts, pseudoalloys)

120271 Preparation of metallic glass ribbons from the pure elements. V.Madurga, E.Ascasibar, J.M.Gonzalez, M.Morala (Lab. Magnetismo, Univ. Complutense, Madrid, Spain), A.Garcia-Escorial, J.A.Peces, O.V.Nielsen.
An. Fis. Ser. B (Spain), vol.79, no.2, p.82-4 (May-Aug. 1983). [received: Oct. 1983]
The authors describe a successful attempt to prepare metallic glass ribbons starting from the pure elements. The composition chosen was

$(Fe_{.05}Co_{.95})_{75}Si_{15}B_{10}$, which is a ferromagnetic material with near-zero magnetostriction. (3 refs.)

120272 Sintering of submicron tungsten-based heavy alloys. V.Srikanth, G.S.Upadhyaya (Indian Inst. of Technol., Kanpur, India).
Int. J. Refract. & Hard Met. (GB), vol.2, no.3, p.121-8 (Sept. 1983).
The densification behaviour of submicron tungsten powder compacts containing 10 weight percent Cu-Ni binders in different proportions was studied. The effect of copper powder size on the sintering behaviour was investigated. (8 refs.)

120273 The use of metallic glasses in fabrication of ICF targets. W.L.Johnson (Keck Lab. of Engng., California Inst. of Technol., Pasadena, CA, USA), M.C.Lee.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1568-70 (1983).
The fabrication of Au-base metallic glass spheres and microballoons used for ICF targets is described. Alloys of composition $Au_{55}Pb_{22.5}Sb_{22.5}$ were used because of its low melting point and high Z number. Metallic glass microspheres have a high degree of sphericity and surface smoothness and deform homogeneously and isotropically under the high strain rates involved in an ICF implosion. (5 refs.)

120274 The effect of fluoride preparation on the purity of the rare earth metals. B.J.Beaudry, P.E.Palmer, K.A.Gschneidner,Jr. (Dept. of Materials Sci. & Engng., Iowa State Univ., Ames, IA, USA).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.277 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
Summary form only given, as follows. The established process used at the Ames Laboratory to prepare the rare earth metals includes the calcium reduction of high purity rare earth fluorides. The preparation of these high purity fluorides in the past has included melting of the fluorides under a dynamic HF-Ar atmosphere to remove the oxygen quantitatively (the resultant compounds are known as 'topped' fluorides). The present research indicates that this melting step is not necessary to prepare fluorides of sufficiently high purity for metal preparation, especially for the light rare earth metals. As an example, the typical oxygen contents of lanthanum, cerium, praseodymium and neodymium prepared from topped fluoride are 34 wt.ppm, 57 wt.ppm, 29 wt.ppm and 40 wt.ppm respectively, while the oxygen contents of the corresponding lanthanides prepared from untopped fluorides are 28 wt.ppm, 59 wt.ppm, 30 wt.ppm and 55 wt.ppm respectively.

120275 Effect of electrolysis time on the magnetic properties of fine iron powders. L.Yu.Ivanova, B.M.Machul'skii, E.P.Zhelibo, A.I.Alekseenko (Inst. of Colloid Chem. & Chem. of Water., Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.22, no.2, p.79-83 (Feb. 1983). Translation of: *Poroshk. Metall. (USSR)*, vol.22, no.2, p.6-11 (Feb. 1983). [received: Sept. 1983]
It was found that an organic layer of 0.5% solution of oleic acid in toluene (layer thickness 1.5×10^{-2} m, ratio between the electrolyte and organic layer volumes 5:1) enabled the electrolytic bath to operate for 4 h without correction of the composition of its organic layer. During periods longer than 4 h trivalent iron oleates extracted in the course of electrolysis from the powder surface into the toluene solution built up in the upper, organic layer of the bath. Iron oleates, which are not readily adsorbed on the electrode surface, reduced the true current density and lead to the formation of powders of low coercive force. Apart from this, they did not passivate the powder and they decreased its magnetic induction. (6 refs.)

120276 Conditions of formation, structure, and magnetic properties of finely divided iron produced in the presence of ED-20 epoxide oligomer and oleic acid. T.N.Amelichkina, E.P.Zhelibo, V.V.Myalkovskii, T.M.Shvets (Inst. of Colloid Chem. & Chem. of Water, Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.22, no.2, p.84-9 (Feb. 1983). Translation of: *Poroshk. Metall. (USSR)*, vol.22, no.2, p.11-17 (Feb. 1983). [received: Sept. 1983]
The authors studied the effect of $FeCl_2.4H_2O$ concentration, pH, and current density on the electrodeposition, structure, and magnetic properties of v/f iron powders produced in a bath with an organic layer containing ED-20 epoxide oligomer and a HFA (oleic acid). They conclude that to obtain powders of satisfactory magnetic properties at high current efficiency in the presence of an oligomer and a HFA, it is necessary to employ low-concentration salts of the metals to be deposited (not more than 50 g/liter) and moderately acid solutions, the current density should lie in the range 9-18 A/dm^2. (9 refs.)

120277 Sintering of tungsten-nickel-iron alloy powders. N.A.Kuz'min, V.P.Matsokin, E.M.Rabinovich (Kharkov State Univ., Kharkov, Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.22, no.2, p.105-9 (Feb. 1983). Translation of: *Poroshk. Metall. (USSR)*, vol.22, no.2, p.35-40 (Feb. 1983). [received: Sept. 1983]
The sintering kinetics of three-component W-Ni-Te alloy powders and powder mixtures were studied as a function of heating conditions, composition, powder particle size, and starting compact porosity. The growing shrinkage of compacts produced at $p \simeq 6 \times 10^2$ Pa was measured continually in a high-temperature differential dilatometer with an accuracy $\Delta\epsilon \simeq \pm 10^{-4}$. The main dilatometric experiments were carried out at a constant heating rate ω ($10^{-1} \leq \omega \leq 1$ deg C/sec), with some experiments being conducted under isothermal conditions. Porosities were determined by hydrostatic weighing with an error $\Delta/\vartheta \sim 10^{-3}$. (9 refs.)

120278 Structure formation in magnetoabrasive materials from iron-carbon melts alloyed with carbide-forming elements. V.E.Oliker, A.F.Zhornyak, V.Ya.Shlyuko, T.Ya.Gridasova, L.A.Karpova (Inst. of Materials Sci., Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.22, no.2, p.142-9 (Feb. 1983). Translation of: *Poroshk. Metall. (USSR)*, vol.22, no.2, p.76-84 (Feb. 1983). [received: Sept. 1983]
It is concluded that the particles of an atomized magnetoabrasive powder from any given alloyed melt have structures differing in macromorphology, which is a result of differences in conditions of solidification of metal drops during melt disintegration. In the presence of carbide-forming elements silicon in an iron-carbon melt dissolves mainly in ferrite, without significantly affecting the morphology of structure of the atomized particles. The effectiveness of magnetoabrasive machining (polishing) depends to a large extent on the choice of abrasive and work materials. (22 refs.)

High coercive force 2-17-type $Sm_{1-x}Er_x(Co_{0.69}Fe_{0.22}Cu_{0.08}Zr_{0.02})_{7.22}$ magnets with a low temperature coefficient .... See Entry 119873

Phase fields and initial melting diagrams of the pseudoquaternary system $UC\text{-}MoC_{1-x}ZrC\text{-}NbC$ .... See Entry 120312

New-generation aluminium alloys through rapid solidification processing .... See Entry 120324

A high performance wrought nickel-base superalloy EI-929 .. See Entry 120372

Resistance to deformation of pressed strips from granulated alloys .... See Entry 120386

High-temperature friction of alloys of the $TiN_x\text{-}TiB_2$ system .... See Entry 120449

Corrosion behaviour of hot-pressed austenitic stainless steel in H_2SO_4 solutions at room temperature .... See Entry 120488

81.20J Dispersion-,fibre-, and platelet-reinforced metal-based composites

120279 Development of a new hybrid material (ARALL) for aircraft structure. L.B.Vogelesang (Dept. of Aerospace Engng., Delft Univ. of Technol., Delft, Netherlands).
Ind. & Eng. Chem., Prod. Res. & Dev. (USA), vol.22, no.3, p.492-6 (Sept. 1983).
A new material for aircraft structures with several promising properties is described. The material is obtained by the adhesive bonding of a number of thin aluminum alloy sheets and aramid layers to produce an aramid reinforced aluminum laminate (ARALL). ARALL shows very favorable fatigue crack growth properties and has a high tensile yield strength. This is especially true if suitable residual stresses are introduced into a laminate with an optimum thickness of metal sheets. In spite of the use of structural fibers in the laminates, nearly all advantages of metals over pure composites are preserved such as plasticity, impact strength, formability, and easy machining. (7 refs.)

120280 Applicability of potassium titanate fiber to metal matrix composites. H.Fukunaga, K.Gohda (Dept. of Mech. Engng., Faculty of Engng., Saijo, Japan), N.Ohta.
Trans. Jpn. Inst. Met. (Japan), vol.24, no.9, p.642-9 (Sept. 1983).
Deals with the reaction of the potassium titanate fiber on four kinds of pure metals (aluminum, nickel, titanium and copper) in air and vacuum at elevated temperatures, in order to find the applicability of the fiber to MMC. The fiber does not react on the aluminum matrix up to the melting point of the matrix. Beyond the point, however, it is found by EPMA line analysis that potassium in the fiber disappears. Up to 1123K, there is no detectable reaction between the fiber and the nickel matrix. The fiber does not react in vacuum on both titanium and copper matrices below the melting point of them, while a violent reaction between the fiber and the matrices occurs in the atmosphere at temperatures higher than 1023K. The above mentioned results suggest that the potassium titanate fiber can be applied as a reinforcement in the aluminum and nickel matrices when the MMC is fabricated in air, as well as in the titanium and copper matrices when fabricated in vacuum. (30 refs.)

81.20L Ceramics and refractories

120281 A dense ceramic based on gadolinium-gallium garnet. O.V.Gorshkova, E.S.Lukin (Chem. Technol. Inst., USSR).
Glass & Ceram. (USA), vol.39, no.11-12, p.609-12 (Nov.-Dec. 1982). Translation of: *Steklo & Keram. (USSR)*, vol.39, no.12, p.18-19 (Dec. 1982). [received: Sept. 1983]
Presents the results of investigations on the technological conditions for obtaining a high-density polycrystalline GGG-based ceramic from a homogeneous charge prepared by calcining amorphous powders of coprecipitated gallium and gadolinium hydroxides from high-concentration solutions of chloride salts. The studies showed that milling (grinding) of the powders of coprecipitated hydroxides before and after synthesis at 1000°C significantly improves the sintering process. Based on GGG, a ceramic with 97.7% relative density was obtained with almost zero open porosity (0.2%), 17% linear shrinkage, 2% intracrystalline porosity, and a grain size of 20-35 μm. (3 refs.)

120282 Synthesis reaction of metatitanate $BaTiO_3$. I. Effect of the gaseous atmosphere upon the thermal evolution of the system $BaCO_3\text{-}TiO_2$. A.Beauger, J.C.Mutin, J.C.Niepce (Lab. de Recherches sur la Reactivite des Solides, CNRS, Dijon, France).
J. Mater. Sci. (GB), vol.18, no.10, p.3041-6 (Oct. 1983).
Thermogravimetric and X-ray diffraction analysis of the reaction mixture, during the synthesis of barium metatitanate $BaTiO_3$ from $BaCO_3$ and TiO_2 allowed clarification of the transformation time and the role of the reaction environment: in air, the occurrence of $BaTiO_3$ is in competition with that of orthotitanate Ba_2TiO_4. The latter forms between 25 and 95% of the transformation of the initial mixture by reaction between $BaCO_3$ and $BaTiO_3$. Under vacuum, metatitanate is not detected before 70% of transformation of the initial mixture. The orthotitanate occurs alone, oxide BaO produced by the decomposition of the carbonate and replaces it in the reaction syntheses. In CO_2, the synthesis of $BaTiO_3$ competes with the formation of a phase other than Ba_2TiO_4 but whose behaviour during calcination is comparable to that of the orthotitanate. (12 refs.)

120283 Formation mechanism of cBN crystals under isothermal conditions in the system $BN\text{-}Ca_3B_2N_4$. T.Sato, T.Endo, S.Kashima, O.Fukunaga, M.Iwata (Nat. Inst. for Res. in Inorganic Materials, Ibaraki, Japan).
J. Mater. Sci. (GB), vol.18, no.10, p.3054-62 (Oct. 1983).
Cubic BN was synthesized by treating hexagonal BN(hBN) in the presence of $Ca_3B_2N_4$ which acted as a flux for BN. After the high pressure and temperature treatments, cBN was obtained in a part of hBN layer initially charged, but hardly in the flux layer. The grains of cBN were precipitated accompanied with the advance of $Ca_3B_2N_4$ flux into hBN zone. From these observations, it can be deduced that hBN dissociated beneath the thin layer of flux advanced, and crystallized as cBN under an isothermal condition. In this system, the mechanism was basically the same as that of the diamond growth in the metal flux such as nickel and cobalt. Namely, the crystal growth of cBN was governed by the difference of solubility between hBN and cBN in a melted $Ca_3B_2N_4$, because of the eutectic relation between BN and $Ca_3B_2N_4$. For the nucleation process, two types of features were observed; one was the preferential nucleation at the boundary of hBN-flux, and the other was the homogeneous nucleation in the part of hBN layer initially charged. (8 refs.)

120284 Preparation of $Bi_4Ti_3O_{12}$ powders in the presence of molten salt containing LiCl. T.Kimura, T.Kanazawa, T.Yamaguchi (Faculty of Sci. & Technol., Keio Univ., Yokohama, Japan).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.597-600 (Aug. 1983).
The reaction between Bi_2O_3 and TiO_2 in molten LiCl-KCl was examined with special emphasis on the reaction mechanism and the size of $Bi_4Ti_3O_{12}$ particles. The oxides reacted with LiCl to form an intermediate compound, which changed into $Bi_4Ti_3O_{12}$ on extended heating. Potassium chloride retarded the reaction between the oxides and LiCl and promoted the change from the intermediate compound to $Bi_4Ti_3O_{12}$. $Bi_4Ti_3O_{12}$ particles prepared in the flux were platelike, irrespective of the preparation conditions, but their

size depended on reaction temperature and time, the ratio of LiCl to KCl, and the amount of flux. (12 refs.)

120285 Diffusional reaction-bonding of Si_3N_4 ceramics under high pressure. T.Kaba, M.Shimada, M.Koizumi (Inst. of Sci. & Industrial Res., Osaka Univ., Osaka, Japan).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.135-6 (Aug. 1983).
Diffusional reaction-bonding of Si_3N_4 ceramics was accomplished by maintaining samples at 3.0 GPa and 1800°C for 1 h. Interfaces of bonded samples were examined by scanning electron microscopy, Vickers microhardness measurements, and electron probe microanalysis. These results indicate that strong bonding between sintered ceramic bodies is achieved by a diffusional reaction at high temperature and pressure. (13 refs.)

120286 Mechanisms of densification during the hot pressing of calcium oxide and synthetic doloma. I.B.Bashir (Dept. of Ceramics, Univ. of Leeds, Leeds, England).
Mater. Sci. & Eng. (Switzerland), vol.61, no.1, p.51-7 (Oct. 1983).
The behaviour of calcium oxide and synthetic doloma during hot pressing was studied. Between 5 and 30 MPa, and at 1380°C, the kinetics of hot pressing were elucidated using grain sizes ranging from 9 to 28 μm. The data obtained were interpreted in terms of transitional behaviour between a lattice diffusion mechanism (Nabarro-Herring creep) at low stresses (i.e. 5-15 MPa) and a dislocation creep mechanism at high stresses (i.e. 15-30 MPa). The mixed mechanism observed was consequently discussed in terms of deformation maps for calcium oxide and doloma. (18 refs.)

120287 Low temperature sintering of TiO_2. M.F.Yan, W.W.Rhodes (Bell Labs., Murray Hill, NJ, USA).
Mater. Sci. & Eng. (Switzerland), vol.61, no.1, p.59-66 (Oct. 1983).
Low temperature sintering was achieved in ultrafine, well-dispersed and uniformly packed TiO_2 powder compacts. TiO_2 powder was prepared by hydrolysis of titanium isopropoxide, calcination at 550°C and dispersion in an aqueous solution with a controlled pH value. A sedimentation process was used to remove any coarse agglomerates in the well-dispersed TiO_2 slurry. The finest particles remaining in suspension were concentrated into uniform compacts by a centrifuge technique. Whereas commercial TiO_2 powder required sintering above 1230°C tc achieve a density which is 96% of the theoretical density the prepared powder could be sintered to greater than 99% of the theoretical density at 840°C. (15 refs.)

120288 Effects of Cr_2O_3 additions on the sintering and mechanical properties of Al_2O_3. H.Tomaszewski (Inst. for Technol. of Elektronic Materials, Warsaw, Poland).
Szklo & Ceram. (Poland), vol.34, no.1, p.1-5 (Jan.-Feb. 1983). [received: Oct. 1983]
The effect of the Cr_2O_3 additions on the penetration of the intergranular phase between alumina grains of 96 wt.% alumina ceramics, by applying the principles of quantitative metallography to the observed microstructures, has been investigated. From the microsections values of the true dihedral angle have been measured. The effect of Cr_2O_3 was significant to increase the dihedral angle and to decrease the alumina ceramics density. As a result of this effect distinct deterioration of mechanical properties of alumina ceramics was observed. (14 refs.)

120289 Effect of nature and chemical structure of water-soluble polymers on structure formation in the ferrite powder-water system and its properties. P.I.Kuprienko, G.S.Pop, N.N.Kruglitskii, A.F.Pashkov, T.V.Slovikovskii, V.E.Soltyk (Inst. of Colloid Chem. & Chemistry of Water, Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.22, no.2, p.94-8 (Feb. 1983). Translation of: *Poroshk. Metall. (USSR)*, vol.22, no.2, p.22-8 (Feb. 1983). [received: Sept. 1983]
The effect of nature and concentration of some water-soluble polymers (WSPs) on the rheology of their solutions and aqueous suspensions of ferrite powders, structure formation in ferrite pastes, and properties of finished parts was investigated. Results demonstrate the feasibility of regulating the processes of structure formation in and the properties of ferrite suspensions by means of water-soluble polymers of various natures and chemical structures. A styrene copolymer with an ammoniacal salt of maleic acid with a degree of ionization of 1.0 (SCASMA-1) may be recommended as a binding plasticizer for manganese-zinc ferrite pressing powders. (7 refs.)

120290 Cold pressing of wurtzite boron nitride powders under high pressures. S.S.Dzhamarov, N.I.Shcherban' (Inst. of Materials Sci., Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.22, no.2, p.102-4 (Feb. 1983). Translation of: *Poroshk. Metall. (USSR)*, vol.22, no.2, p.32-4 (Feb. 1983). [received: Sept. 1983]
A study was made of the compressibility of wurtzite boron nitride powders containing various amounts of graphitelike boron nitride. For all the powders investigated the relationship between compact density and pressing pressure was found to be of the same type. It is shown that the densification of wurtzite boron nitride powders and, apparently, other powdered superhard materials under conditions of high pressures can be described by logarithmic or power expressions. The physical meaning of the constants of the powder pressing equations is explained. Pressures necessary for attaining some given structures and densities in the pressing of powdered superhard materials are estimated. (7 refs.)

Unit-cell parameters of titanium oxynitrides .... See Entry 118965

Preparation and melting point of octalithium zirconate .... See Entry 119162

Ferroelectric properties of compounds with magnesium orthotellurate structure ....See Entry 119992

High-temperature friction of alloys of the TiN_x-TiB_2 system ....See Entry 120449

81.20N Cermets, ceramic and refractory composites

120291 Sintering of tin oxide ceramic with additives. T.E.Os'kina, K.B.Zaborenko, I.G.Mel'nikova, T.I.Pron'kina (Moscow State Univ., Moscow, USSR).
Glass & Ceram. (USA), vol.39, no.11-12, p.617-20 (Nov.-Dec. 1982). Translation of: *Steklo & Keram. (USSR)*, vol.39, no.12, p.21-2 (Dec. 1982). [received: Sept. 1983]
It was found that sintering of the systems based on SnO_2 with ZnO and Nb_2O_5 additions was determined not only by the formation of solid solutions but also, to a considerable extent, by the mutual interaction of the additives resulting in the formation of chemical compounds or eutectics. This is why maximum density was achieved when SnO and Nb_2O_5 additives were introduced with a mass content close to the eutectic composition in the phase diagram. Such a composition of the system should be regarded as optimum for decreasing the sintering temperature and obtaining a ceramic with higher density. (5 refs.)

120292 Thermostable material from fluorophlogopite and an organosilicon binder. E.Z.Asnovich, V.A.Kolganova (All-Union Sci.-Res. & Technol. Planning Inst. of Insulating Materials & Foil Dielectrics, USSR).
Inorg. Mater. (USA), vol.18, no.10, p.1508-12 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1755-8 (Oct. 1982). [received: Sept. 1983]
A new inorganic material, SFK mica sheet, was obtained from fluorophlogopite paper, and an organosilicon binder. Its chemical composition and physicochemical and electrical properties were studied by heating to 850°C. It was found that the material exhibits high thermostability. (3 refs.)

120293 Microstructure of sintered mullite-zirconia composites. S.Prochazka, J.S.Wallace, N.Claussen (Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.125-7 (Aug. 1983).
Fused mullite, pure and with 10 to 25 vol.% ZrO_2 added, was milled in an attritor and sintered in air at temperatures near 1600°C to a dense fine-grained ceramic. The ZrO_2 promoted densification and retarded grain growth of the mullite phase. Transmission electron microscopy showed that compositions containing ZrO_2 were substantially free of glass, whereas pure mullite bodies contained a glassy phase. The ZrO_2 formed intergranular, isolated particles. (17 refs.)

120294 Detection of thin intergranular cobalt layers in WC-Co composites by lattice imaging. V.Jayaram, R.Sinclair (Dept. of Materials Sci. & Engng., Stanford Univ., Stanford, CA, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.137-9 (Aug. 1983).
Much discussion has taken place concerning the contiguity of the carbide phase in sintered WC-Co composites. The lattice fringe imaging technique was used to demonstrate that WC grains which appear macroscopically contiguous are sometimes truly so at the atomic level. In other instances, they are separated by films of cobalt $\approx$1 nm thick. (5 refs.)

81.20P Glasses

120295 Preparation of titania-silica glasses by the gel method. T.Hayashi, T.Yamada, H.Saito (Dept. of Appl. Chem., Nagoya Univ., Nagoya, Japan).
J. Mater. Sci. (GB), vol.18, no.10, p.3137-42 (Oct. 1983).
A series of bulk glasses in the TiO_2-SiO_2 system have been prepared by hydrolysing the mixture solution of $Ti(OC_3H_7)_4$ and $Si(=OC_2H_5)_4$ with water and hydrochloric acid, and slowly heating the resultant gels up to 800°C. The conversion of gels to glasses was examined by the measurements of Vickers hardness, IR and TGA. The properties of TiO_2-SiO_2 glasses in the less than 12.9 wt.% TiO_2 range obtained by the gel method were very similar to those of oxide glasses made by the flame hydrolysis process. These glasses showed ultra-low thermal expansion, but the precipitation of anatase remarkably increased the thermal expansion. In the less than 10.4 wt.% TiO_2 range, the glasses obtained by heating up to 800°C were not crystallized at 1000°C or higher, while in the more than 20 wt.% TiO_2 range anatase was precipitated at 900°C. It was found that glasses obtained by the gel method were a true solid solution at least up to 7.4 wt.% TiO_2 composition. (9 refs.)

120296 Computer calculations of optimum glass compositions. B.Ziemba, M.Olkusnik, W.Ziemba, E.Kowalska, K.Manczak.
Szklo & Ceram. (Poland), vol.34, no.4, p.127-31 (July-Aug. 1983). In Polish.
The mathematical models have been elaborated of the relations between the chemical composition of a glass and the 28 parameters describing the properties of this glass. The composition selected were of 74 glasses in the system SiO_2-Al_2O_2-CaO-MgO-Na_2O-K_2O: additionally literature data for 14 more glasses were used for the purposes of glass optimisation. For each of the glasses optimum decisions and limiting conditions of the optimisation have been formulated, and the programs written for ODRA-1305 in FORTRAN 1900. (14 refs.)

Reinforcing laminates with the glass fibers ....See Entry 120305

81.20S Polymers

120297 Soluble polyacetylene. G.L.Baker, F.S.Bates (Bell Labs., Murray Hill, NJ, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.11-16 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Soluble block copolymers containing polyacetylene have been prepared in which the polyacetylene segment is isolated in solution. The characterization of this material by infrared, visible, and NMR spectroscopy is described. (10 refs.)

120298 Formation of highly conducting derivatives of polyacetylene through oxidation with selected metal halides. D.Billaud (Lab. de Chimie du Solide Mineral, Univ. de Nancy I, Nancy, France), I.Kulszewicz, A.Pron, P.Bernier, S.Lefrant.
J. Phys. Colloq. (France), vol.44, no.C-3, p.33-5 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Some new metal halides ($InCl_3$, InI_3, $TiCl_4$, TiI_4, $SnCl_4$, $ZrCl_4$) can oxidize polyacetylene with the formation of highly conducting polymers characterized by elemental analysis, mass uptake and physical methods. Electrical conductivities and EPR spectra are in agreement with the metallic behaviour of these new materials. (7 refs.)

120299 Designed synthesis of novel one-dimensional materials with pseudo-$(SN)_x$ bundle-structure. M.Megnamisi-Belombe (Dept. of Chem., Univ. of Ife, Ile-Ife, Nigeria).
J. Phys. Colloq. (France), vol.44, no.C-3, p.717-21 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The aim is to synthesize new one-dimensional materials in which suitable metal complexes crystallizing in a stacking structure are to produce infinite linear chains of the central metal ions closely surrounded by parallel pseudo-$(SN)_x$ chains. The author therefore combined transition metal complexes based on α, β-dione dioximate (α, β-dodo) ligands with those based on α, β-dithiolate (α, β-dt) ligands in 1:1 molar ratios, assuming that they may crystallize in an alternated stacking structure. With diphenylethanedione dioximate (dpg) as the α, β-dodo, and diphenylethenedithiolate (dpedt) as the α,β-dt ligands, for example, the author has prepared a number of complexes which crystallize in dark, lustrous long needles typified by the 1:1 $Cu(dpg)_2/Ni(dpedt)_2$ and $Cu(dpg)_2/Pt(dpedt)_2$ systems. (5 refs.)

120300 Conducting SN polymers with integrated organic groups. G.Wolmershauser, R.Jotter, T.Wilhelm (Fachbereich Chem., Univ. Kaiserslautern, Kaiserslautern, Germany).
J. Phys. Colloq. (France), vol.44, no.C-3, p.729-32 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Polymers consisting of alternating sulfur nitrogen moieties and bifunctional heterocyclic groups are prepared via Si-N bond cleavage. All compounds are obtained in good yields as highly coloured or black materials which are insoluble in common organic solvents. The pristine materials show conductivities of approximately 5.10^{-16}-5.10^{-5} $\mathrm{Ohm}^{-1}\ \mathrm{cm}^{-1}$. In most cases higher conductivities can be achieved by doping the samples with acceptors, e.g. iodine. (7 refs.)

120301 Modified and free-flowing natural rubber. R.Gaczynski, L.Ciechanowicz (Inst. Przemyslu Gumowego Stomil, Piastow, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.4, p.109-13 (April 1983). In Polish. [received: Oct. 1983]
On the basis of literature data, the problem of modifying natural rubber has been discussed, and the possibility of practical utilization of the modified products with a view to their properties and profitability of production has been analyzed. In respect of their properties, these products are similar to thermoplastic rubbers, but the possibility of their application is rather doubtful. Various methods of preparing natural rubber in free-flowing form have also been considered. As the price of this rubber type lowers, it can find application in the rubber industry due to lower energy consumption used in its processing. (26 refs.)

Synthesis and properties of $(CH)_x$-films prepared by polymerization of BTFM-TCDT ....See Entry 118911

Preparation and properties of high quality polyacetylene ....See Entry 120053

Poly(para phenylene): Some properties related to the synthesis method ....See Entry 120065

Residual stresses in plastics sheet and injection mouldings ....See Entry 120325

Epoxy materials with good optical properties for applications in electron optics ....See Entry 120456

Chlorination of natural rubber vulcanizates in chlorine solutions in halogenated hydrocarbons ....See Entry 120618

Polymerization of acetylene with new catalysts, new doping agents, morphology and electrical conductivity of the doped polyacetylene films ..See Entry 120627

Semiconductor properties of the anodic polymer obtained on platinum from selenocyanate ammoniate ....See Entry 120632

81.20T Reinforced polymers and polymer-based composites

120302 Fabrication of a composite recording disc substrate. H.M.Hinkel (IBM Deutschland GmbH, Sindelfingen, Germany).
Composites (GB), vol.14, no.4, p.377-82 (Oct. 1983).
Composite magnetic recording discs, comprising carbon fibre-and glass fibre-reinforced epoxies clad by stainless steel foils, were fabricated by press moulding of prepregs, post-moulding machining of the inner and outer diameter (169 mm and 356 mm respectively) and surface polishing. The optimum flatness achieved was within 80 μm. Vacuum deposition of magnetic thin films on top of such composite substrates is feasible. Environmental humidity probably does not cause warpage or substrate weight increase exceeding the requirements for magnetic recording discs. However, the printing of fibre tows through the metal foils must be avoided, as must warpage caused by post-polishing. (8 refs.)

120303 The use of three-component polymeric composites in preparing a channel electron multiplier. B.Jachym, G.Wisniewski (Dept. of Phys., Tech. Univ. of Gdansk, Gdansk, Poland).
J. Phys. D (GB), vol.16, no.10, p.2023-32 (14 Oct. 1983).
The characteristics of secondary electron emission (SEE) of three-component composites including organic compounds have been investigated. The maximum SEE yield for conductive composites which consist only of polyvinylchloride and electroconductive particles such as NATCNQ and carbon black is low (less than 1). The addition of a third component, such as titanium, magnesium or beryllium oxides, sodium chloride, or the complex of TCNQ with anthracene, has enabled the authors to produce composites characterised by high maximum SEE yields for low energy of primary electrons. The study of the SEE yield from such electron-conductive polymeric composites shows that the SEE yield depends above all on the species and quantity of the third compound. On the basis of the data obtained a channel electron multiplier CEM has been developed. The CEM made of the three-component system is characterised by a gain of 10^7 to 10^8 (3 kV) at the maximum output current of 10^{-6} A. (10 refs.)

120304 A method for the evaluation of filler dispersion in vulcanized rubber. J.Milewska-Duda (Inst. Energochemii Wegla i Fizykochemii Sorbentow AGH, Krakow, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.3, p.85-6 (March 1983). In Polish. [received: Oct. 1983]
A method for the initial evaluation of filler dispersion in elastomer phase on the basis of density of filler, vulcanized rubber without filler, and filled vulcanized rubber has been presented. By way of example, calculation of the degree of dispersion for natural rubber vulcanizates filled with Sapex-20 carbon black has been presented. (4 refs.)

120305 Reinforcing laminates with the glass fibers. J.Tomaszewski, A.Wierdak.
Szklo & Ceram. (Poland), vol.34, no.4, p.131-6 (July-Aug. 1983). In Polish.
The development of the production of glass fibers in Krosno is desribed. The properties of Krosno fibers and the assortment of fibers made are discussed. The importance of sizing is stressed. Some information is given concerning the studies of the glass fibers in Krosno and the prospective plans of further development. (6 refs.)

120306 Development of high performance short fibre reinforced thermoplastics. R.H.Burton, M.J.Folkes, D.Kells (Dept. of Non-metallic Materials, Brunel Univ., Uxbridge, England).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.40/1-6
Short fibre reinforced thermoplastics are successfully being used in a wide range of engineering applications. However, there is considerable potential for further improvements in properties. To this end the authors have re-assessed the design of the material in the light of composite mechanics and have investigated the role of the interface and the effects of fibre attrition on component properties. (7 refs.)

Electrically conductive polymer-polymer composites ....See Entry 119604

81.30 PHASE DIAGRAMS AND MICROSTRUCTURES DEVELOPED BY SOLIDIFICATION AND SOLID-SOLID PHASE TRANSFORMATIONS

(see also 61. Structure of liquids and solids 64.70 Phase equilibria, phase transitions, and critical points)

120307 Thermal behaviour of poly(β-ketothioethers). F.Pilati (Istituto Chimico, Univ. di Bologna, Bologna, Italy), F.Andreani, L.Angiolini, P.Costa Bizzarri, C.Della Casa, P.Ferruti, N.Ghedini, M.Tramontini.
Polym. Commun. (GB), vol.24, no.10, p.309-13 (Oct. 1983).
The thermal behaviour of several polymers belonging to a new class, poly(β-ketothioethers), has been investigated by d.s.c. Many of these polymers are crystalline and show evidence of reorganization processes on heating. Their melting behaviour and thermal stability was found to be dependent on their chemical structure. (7 refs.)

120308 High-resolution electron microscopy of chemically vapor-deposited β-Si_3N_4-TiN composites. K.Hiraga, M.Hirabayashi, S.Hayashi, T.Hirai (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.539-42 (Aug. 1983).
Microstructures of Si_3N_4-TiN composites prepared by chemical vapor deposition (CVD) were investigated by the multibeam imaging technique using a 1 MV electron microscope. High-resolution images showed a number of fibrous TiN crystallites dispersed in the matrix of CVD β-Si_3N_4. Crystallographic orientation relations between β-Si_3N_4 and TiN were determined directly from the observed images in the subcell scale. The fibrous axis of TiN is parallel to the $\langle 110 \rangle$ direction of the NaCl structure and lies along the c axis of the hexagonal β-Si_3N_4 crystal. Domain boundaries, planar faults, nonplanar faults, and dislocations were found in the CVD β-Si_3N_4 matrix near the TiN crystallites. The origin of the structure defects is briefly discussed in connection with the formation of TiN crystallites in the matrix. (9 refs.)

120309 The arrangement of cells in a net. II. D.A.Aboav.
Metallography (USA), vol.16, no.3, p.265-73 (Sept. 1983).
For pt.I see ibid., vol.13, p.43 (1980). The arrangement of the differently shaped domains into which a thin film of arsenic-selenium glass is found to divide is compared with that of the cells of a foam and the grains of a polycrystal. The significance of the parameters of an empirical equation describing the arrangement is briefly discussed. (8 refs.)

Glass forming ability of alloys on the basis of Fe-C ....See Entry 118899

Microstructural changes near the coherent spinodal line in the Fe-Mo alloy system ....See Entry 120360

On the microstructure of teflon-bonded platinum-carbon electrodes ....See Entry 120641

81.30B Phase diagrams of metals and alloys

120310 The molybdenum corner of the ternary system Mo-Cr-B. A.M.Zakharov, S.I.Yudkovskii, Yu.S.Popova (Moscow Steel & Alloy Inst., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.10, p.1472-4 (Oct. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.10, p.1714-16 (Oct. 1982). [received: Sept. 1983]
The Mo-Cr-B ternary system has been studied in the molybdenum-rich region (up to 0.2 wt.% each of chromium and boron) by metallographic and X-ray diffraction analysis, alloy solidus temperature determination, and boride phase microhardness; isothermal sections have been plotted at 1950, 1600, and 1200°C and polythermal sections at a Cr:B ratio of 1:1 and a constant boron content of $\sim$0.02 wt.%. The alloys studied after quenching from 1200-1950°C have a single-phase or two-phase structure, containing in addition to the molybdenum-based solid solution a second phase consisting of a solid solution of chromium in Mo_2B or $(Mo, Cr)_2B$ with a tetragonal lattice ($CuAl_2$ type). The combined solubility of boron and chromium in molybdenum in the solid state falls as the temperature is lowered and as the chromium content increases. The microhardness of the boride Mo_2B in the alloy Mo+0.15B (wt.%) quenched from 1200°C is 17700±500 MPa, and that of the boride phase $(Mo, Cr)_2B$ in the alloys Mo+0.10Cr+0.16B and Mo+0.17Cr+0.51B (wt.%) is 17800 to 18500 MPa. (9 refs.)

120311 Phase composition and phase stability of a high-chromium nickel-based superalloy, IN939. K.M.Delargy, G.D.W.Smith (Dept. of Metall. & Sci. of Materials, Univ. of Oxford, Oxford, England).
Metall. Trans. A (USA), vol.14A, no.9, p.1771-83 (Sept. 1983).
The experimental techniques of atom probe time of flight mass spectrometry, field emission STEM X-ray microanalysis, and electron probe X-ray microanalysis have been used to investigate the composition and stability of the various phases in alloy IN939 as a function of heat treatment and long-term exposure. The results show a need for some refinement of phase stability calculations, in particular, to take into account the incomplete partitioning of alloy elements between phases and the effects of different exposure conditions during service. The effects of segregation during casting have also been investigated. (26 refs.)

120312 Phase fields and initial melting diagrams of the pseudoquaternary system UC-MoC_{1-x}ZrC-NbC. V.F.Funke, I.V.Pshenichnyi, L.A.Pliner, Yu.D.Loktionov.
Sov. Powder Metall. & Met. Ceram. (USA), vol.22, no.2, p.110-16 (Feb. 1983). Translation of: *Poroshk. Metall. (USSR)*, vol.22, no.2, p.41-7 (Feb. 1983). [received: Sept. 1983]
An account is given of an investigation of the phase compositions and initial melting points of alloys of the quasiquaternary system UC-MoC_{1-x}-ZrC-NbC. The starting alloy components were $U_{0.51}C_{0.49}$, $Zr_{0.508}C_{0.492}$, $Nb_{0.506}C_{0.494}$ (free carbon less than 0.1%, O and N less than 0.03%), and $Mo_{0.58}C_{0.42}$ (free carbon 0.3%, O and N less than 0.01%). The cubic modification of molybdenum carbide was stabilized by adding to it 2% Ti. (4 refs.)

120313 On the Co-Ti system. B.Uhrenius (Sandvik AB, Stockholm, Sweden), K.Forsen.
Z. Metallkd. (Germany), vol.74, no.9, p.610-15 (Sept. 1983).
Cobalt rich Co-Ti alloys were investigated by making micro-probe and X-ray measurements on quenched DTA-specimens and diffusion couples. Equilibria involving the liquid, FCC-Co, Co_3Ti (ordered FCC) and Co_2Ti phases were analysed. The cubic Co_2Ti-phase was found in equilibrium with the Co_3Ti-phase in contradiction to information available in the literature. The experimental information was analysed in thermodynamic terms and the Co-rich part of the phase diagram was calculated using these results. (24 refs.)

Ordering effects in the Fe-Al system .... See Entry 118892

Enthalpy of formation and transformation in binary and ternary systems of the metals iron, cobalt, nickel and molybdenum .... See Entry 119232

An AEM investigation of the formation of precipitate-free zones in an Al-16 wt.% Ag alloy: determination of equilibrium and metastable solvus lines .... See Entry 120339

81.30D Phase diagrams of other materials

120314 Experimental aspects of solid galvanic cell methods for thermodynamic studies on alloys. H.Kleykamp (Kernforschungszentrum Karlsruhe, Inst. fur Material- und Festkorperforschung, Karlsruhe, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.777-81 (Sept. 1983).
The phase diagrams of the ZrO_2-CaO, ZrO_2-Y_2O_3, ThO_2-Y_2O_3 and ThO_2-La_2O_3 systems are discussed in view of the use of the electrolytes in EMF measurements. Thermodynamic studies on metallic A-B systems using solid galvanic cells with oxygen and fluorine ion conducting electrolytes require the knowledge of the phase diagrams of the corresponding ternary A-B-O and A-B-F systems for the cell arrangements. Examples for misleading EMF measurements by use of incompatible electrodes are given. Asymmetric cells, side reactions between the electrodes and the electrical leads, and impurities in the cover gas as sources for erroneous EMF measurements are demonstrated. The characteristics of reference electrodes for oxide electrolytes in environments with different oxygen partial pressures are outlined. The role of oxygen as an impurity in the electrodes for CaF_2 electrolytes is investigated. (32 refs.)

120315 Phase composition of vacuum condensates in the Y_2O_3-ZrO_2 system. G.I.Batalin, V.D.Kushkov, O.V.Kachur, L.V.Pashchenko, I.S.Koslov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.77-8 (1983). In Ukrainian.
The Y_2O_3-ZrO_2 condensates were obtained by electron-beam evaporation and condensation in vacuum. Data on their phase composition are presented. Temperature and concentration limits of the field of the preferential crystallite orientation are also revealed. (5 refs.)

120316 Solid-state quaternary phase equilibrium diagram for the Hg-Cd-Te-O system. D.R.Rhiger, R.E.Kvaas (Santa Barbara Res. Center, Goleta, CA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1712-18 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
For the Hg-Cd-Te-O system an approximate three-dimensional diagram of quaternary phase equilibrium at room temperature has been constructed for the first time, to aid in the study of $Hg_{1-x}Cd_xTe$ surface oxides. Thermodynamic calculations based on standard Gibbs energies of formation were performed to determine which phases are mutually stable. Stability relationships were checked by reaction experiments in mixtures of bulk reference compounds, using Raman spectroscopy for analysis. Elemental Hg is shown to coexist in equilibrium with all of the oxide and telluride phases. Thus, it is likely to be present whenever oxidation is incomplete. $CdTeO_3$ is shown to be stable with respect to the other oxides and tellurides. Several instabilities are indicated, in which an oxide can react with the $Hg_{1-x}Cd_xTe$ to release elemental Hg or Te, or HgTe. (15 refs.)

120317 Phase equilibria in the ZnO-CdO-Fe_2O_3 system with a concentration of Fe_2O_3 of less than 50 mole %. L.A.Bashkirov, N.V.Kornilova (Inst. of Solid-State Phys. & Semiconductors, Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1587-90 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1847-9 (Nov. 1982).
The compositions of the phases in equilibrium were determined by X-ray phase analysis for the range of compositions of the ZnO-CdO-Fe_2O_3 ternary system bounded by $ZnFe_2O_4$-$CdFe_2O_4$ and ZnO-CdO oxide systems at a calcining temperature of 1275K, and the phase diagram, consisting of two two-phase regions and one three-phase region, was plotted. Zinc-cadmium ferrites and solid solutions of CdO in ZnO and ZnO in CdO are the coexisting phases in the two-phase regions. Solid solutions of $Zn_{0.75}Cd_{0.25}Fe_2O_4$, $Zn_{0.88}Cd_{0.12}O$, and $Cd_{0.94}Zn_{0.06}O$ are in equilibrium in the three-phase region. Limited reciprocal solubility of the components is observed in the ZnO-CdO binary system. (4 refs.)

120318 Interaction in the system ZrO_2-MgO-$MgCr_2O_4$. S.G.Sennikov, G.E.Revzin (All-Union Sci. Res. & Design Inst. for Aluminum, Magnesium, Electrode Industry, USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1651-3 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1915-16 (Nov. 1982).
The melting points were determined by the micro-DTA technique in three series of isoconcentrates containing 5, 10, and 15 mole % MgO. The proportions of spinel and zirconium dioxide were varied at intervals of 5 mole %. The solubility in the solid phase was studied in samples annealed in argon atmosphere at 1750°C for 48 h and quenched at room temperature. The concentrations of the dissolved phases were determined by X-ray diffraction and microdiffractospectral analyses. The pattern of the meltability curves of the investigated isoconcentrates indicates absence of ternary compounds. The shift of the eutectic points of the isoconcentrates to the region richer in ZrO_2 and rise of their temperatures should be taken note of as a general mechanism. (7 refs.)

120319 Comments on 'Phase equilibria in the Mn_2O_3-Mn_3O_4-MnO system in CO_2-H_2 mixtures'. M.Keller, R.Dieckmann (Inst. for Phys. Chem. & Electrochem., Univ. of Hanover, Hanover, Germany).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.9, p.650-1 (Sept. 1983).
Comments are made on the paper by Terayama et al. (see ibid., vol.24, p.24, 1983), in which experimental results on the stoichiometry of two manganese oxides, manganosite and hausmannite, as a function of temperature and O_2 partial pressure were reported. By comparing these results with data from Bransky and Tallan (1971) and new measurements by the present authors, it is found that considerable discrepancies are evident. (5 refs.)

The silver iodide-thallium iodide pseudo-binary system .... See Entry 119156

Study of the phase diagrams of graphite intercalation compounds .... See Entry 119159

The role of lattice strain in the phase equilibria of III-V ternary and quaternary semiconductors .... See Entry 119362

The low temperature P-T phase diagram of TTF-TCNQ .... See Entry 119577

Sintering of tin oxide ceramic with additives .... See Entry 120291

81.30F Solidification

(see also 64.70D Solid-liquid transitions)

120320 Mechanical properties of Sn-Ag_3Sn alloys. J.F.Bromley, F.Vnuk, R.W.Smith (Dept. of Metall. Engng., Queen's Univ., Kingston, Ontario, Canada).
J. Mater. Sci. (GB), vol.18, no.10, p.3143-53 (Oct. 1983).
The structure and properties of Sn-Ag_3Sn directionally-frozen eutectic alloys have been examined over the growth range 2×10^{-4} to 2×10^{-1} mm sec^{-1}. The structure is predominantly broken lamellar to 1.3×10^{-2} mm sec^{-1}, but with relatively poor alignment to the growth direction at smaller growth rates. The tensile and compressive strengths were measured. These increase monotonically to the growth rate at which cellular growth ensues, after which point they fall. The hardness of the eutectic closely parallels the compressive properties as the growth rate increases. Quenching from 200°C produces a marked increase in compressive strength and hardness, attributed to the quench-hardening of the Sn-rich phase. (32 refs.)

120321 Solidification and solid state transformations during cooling of chromium-molybdenum white cast irons. J.D.B.DeMello, M.Durand-Charre, S.Hamar-Thibault (ENSEEG Domaine Univ., Saint Martin d'Heres, France).
Metall. Trans. A (USA), vol.14A, no.9, p.1793-801 (Sept. 1983).
Two series of Cr, Mo white cast irons were investigated by different techniques. Differential thermal analysis was carried out to determine the liquidus and eutectic temperatures. Unidirectional solidification was used to promote coarser structures easier to analyze. Furthermore, the microstructures of the sample, quenched during a slow unidirectional solidifcation, illustrate the behavior of the alloy during continuous cooling. The precipitates were characterizd by scanning and transmission electron microscopy and microprobe analysis. The main findings are reported: (1) a correlation was found between the end of solidification and the chromium to carbon ratio; (2) the determination was made of the crystallization path; (3) in some high Cr/C ratio alloys a peritectic reaction occurs on the border of the grain giving a δ ferritic phase; (4) then this δ ferrite was found to decompose in a complex manner giving austenite and ferrite probably in a lamellar structure, then precipitates of M_6C and Mo_2C in the austenitic and ferritic phases, respectively; and (5) according to the kinetics of cooling, some alloys undergo martensitic and bainitic transformations. (20 refs.)

120322 Process and structural aspects of melt-spun nickel-based superalloy ribbons. H.H.Liebermann (General Electric Corporate Res. & Dev., Schenectady, NY, USA), R.E.Maxwell, R.W.Smashey, J.L.Walter.
Metall. Trans. A (USA), vol.14A, no.9, p.1817-23 (Sept. 1983).
Various experimental aspects regarding the chill block melt-spinning of nickel-base superalloy ribbons have been investigated. High speed movies have been used to characterize the process, which is found to obey empirical equations aready established for amorphous and low melting temperature crystalline alloys. Extensive characterization of ribbons formed has been used to assess variations in solidification rate caused by the adjustment of process parameters. Various ribbon microstructures are related to the cooling rate at local points within the ribbon during melt-spinning and are explained in terms of the effects of limited sample-substrate wetting and ribbon thickness. Theoretical and experimental factors affecting microstructural development are discussed. (30 refs.)

120323 Microstructural modification of austenitic stainless steels by rapid solidification. J.M.Vitek, A.Dasgupta, S.A.David (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Metall. Trans. A (USA), vol.14A, no.9, p.1833-41 (Sept. 1983).
The microstructural modifications in three austenitic stainless steels (types 308, 310, and 312) were evaluated after rapid solidification. These three steels are commonly used weld filler metals. Two methods of rapid solidification were investigated, autogenous laser welding and arc-hammer splat quenching. The structure of 310 stainless steel was found to be 100% austenite, and did not vary over the range of conditions studied. On the contrary, the structures of types 308 and 312 steels were very sensitive to the cooling rates and solidification conditions. With the highest cooling rates, the type 308 structure was fully austenitic while the type 312 structure was fully ferritic. At lower cooling rates the structures were duplex ferrite plus austenite. The results were interpreted in terms of faster kinetics of solidification of austenite compared to ferrite under the conditions examined. A comparison of the structures produced by the two rapid solidification techniques indicated the cooling rates are comparable. (24 refs.)

120324 New-generation aluminium alloys through rapid solidification processing. T.R.Anantharaman (Inst. of Technol., Banaras Hindu Univ., Varanasi, India).
Proc. Indian Natl. Sci. Acad. Part A, vol.49, no.1, p.1-17 (1983).
The author considers rapid solidification processing, particularly for the development of new-generation aluminium alloys. The process is described, together with the properties of aluminium and the improvement of its alloys. The underlying science-technology-engineering R&D sequence is highlighted and the consequences for industry in India are discussed. (5 refs.)

120325 Residual stresses in plastics sheet and injection mouldings. N.J.Mills (Dept. of Metall. & Materials, Univ. of Birmingham, Birmingham, England).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.36/1-5
Extruded and injection moulded plastics products solidify under conditions which cause high temperature gradients. For flat products which solidify at atmospheric pressure the contraction in overall length during solidification leads to a roughly parabolic variation in the in-plane residual stresses, with tensile stresses at the mid-thickness. Some factors that affect the residual stress development in injection mouldings have been analysed, in particular the pressure variation in the core of a flat moulding, and the two-dimensional heat flows near reinforcing ribs and the corners of mouldings. (4 refs.)

Direct microscopic and microholographic observations of the solidification of particles from rapidly stirred melts .... See Entry 117226

Structure and properties of a rapidly quenched commercial Al-Mn alloy .... See Entry 120361

81.30H Constant-composition solid-solid phase transformations: polymorphic, massive, and order-disorder

(see also 64.70K Solid-solid transitions)

120326 Phase transitions and thermoluminescence of a plasma-sprayed zinc silicate phosphor. T.Takamori, D.B.Dove (IBM Corp., Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), C.L.Huffine.
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.127-9 (Aug. 1983).
A plasma-sprayed zinc silicate phosphor was heat-treated at ≈800°C in forming gas; the major phase present was the metastable β phase, as revealed by bright yellow fluorescence under UV excitation. On heat treatment at ≈1000°C in air, a green fluorescence developed as a result of the formation of the stable α phase. However, its thermoluminescence characteristics were different from those of the original Pl phosphor used for spraying. (20 refs.)

120327 Kinetics of Austenite-pearlite transformation in eutectoid carbon steel. E.B.Hawbolt, B.Chau, J.K.Brimacombe (Dept. of Metall. Engng., Univ. of British Columbia, Vancouver, BC, Canada).
Metall. Trans. A (USA), vol.14A, no.9, p.1803-15 (Sept. 1983).
The kinetics of the austenite-to-pearlite transformation have been measured under isothermal and continuous-cooling conditions on a eutectoid carbon (1080) steel using a diametral dilatometric technique. The isothermal transformation kinetics have been analyzed in terms of the Avrami equation containing the two parameters n and b; the initiation of transformation was characterized by an empirically determined transformation-start time (t_{Av}). The parameter n was found to be nearly constant; and neither n nor b was dependent on the cooling rates between T_{A1} and the test temperature. Continuous-cooling tests were performed with cooling rates ranging from 7.5 to 108°C per second, and the initiation of transformation was determined. Comparison of this transformation-start time for different cooling rates with the measured slow cooling of a test coupon immersed in a salt bath indicates that, particularly at lower temperatures, the transformation in the traditional T-T-T test specimen may not be isothermal. (21 refs.)

120328 Single crystal neutron diffraction study of the long-range order in Cu_2NiZn. G.van der Wegen (Dept. of Appl. Phys., Univ. of Groningen, Groningen, Netherlands), R.Helmhold, P.Bronsveld, J.De Hosson.
Z. Metallkd. (Germany), vol.74, no.9, p.592-7 (Sept. 1983).
The long-range Zn ordering in Cu_2NiZn is determined as a function of the annealing temperature by single crystal neutron diffraction. It is well established that the character of the order-disorder transition at 767K is of first order. Ordering data obtained from electron microscopic observation of the separation between superlattice dislocations are consistent with the authors' results. An attempt to determine the Cu/Ni ordering below 574K was not yet successful mainly because the kinetics of the ordering at such low temperatures is rather slow. (13 refs.)

Solidification and solid state transformations during cooling of chromium-molybdenum white cast irons .... See Entry 120321

Diffraction-contrast study of microstructure and deformation process of WC-Co cemented carbide .... See Entry 120370

Microstructure and mechanical properties of Zn-Al alloys at room temperature .... See Entry 120379

81.30K Martensitic transformations

(see also 64.70K Solid-solid transitions)

120329 On the effect of fine grain size on the M_s temperature in Fe-27Ni-0.025C alloys. P.J.Brofman (IBM Corp., Hopewell Junction, NY, USA), G.S.Ansell.
Metall. Trans. A (USA), vol.14A, no.9, p.1929-31 (Sept. 1983).
In the light of recent findings the authors examine three previously stated theories for depression of the martensite start temperature, M_s, as a result of grain refinement. As previously postulated, Hall-Petch strengthening is the only viable explanation. (23 refs.)

Computation of phase transformations in heterogeneous solids .... See Entry 119189

Can inherited textures in the BCC phase furnish information about the type of transformation from the FCC phase? .... See Entry 120350

On the high-energy product Fe-Pt permanent magnet alloys .. See Entry 120455

81.30M Precipitation

(inc. segregation; see also 64.75 Solubility, segregation and mixing)

120330 Structurally free cementite in low-carbon steels. V.V.Parusov, K.F.Starodubov, B.F.Martsiniv, V.I.Sukhomlin, V.A.Oliinik.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.82-4 (1983). In Ukrainian.
It is suggested that the mechanism of the structurally free cementite formation in mild steel is based on the kinetic theory of phase transformation. Recommendations on cooling regimes which eliminate the structurally free cementite formation are given for low-carbon austenite. (6 refs.)

120331 Cleaning effect of rare earths on grain boundary segregation in steels. Luo Di, Xing Guohua (Central Iron & Steel Res. Inst., Min. of Metall. Industry PRC, Beijing, China), Zhou Huiliang, Yan Shensheng, Yu Zhizhong, Luo Xinghua.
J. Less-Common Met. (Switzerland), vol.93, no.2, p.278 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
Summary form only given, as follows. The segregation of sulphur and phosphorus at the grain boundaries of the austenite and cast structures of high speed steels was studied in detail using Auger electron spectroscopy. The more sulphur and phosphorus the steel contained, the greater was the segregation. The addition of rare earths to the steel caused a rapid decrease in the sulphur and phosphorus grain boundary segregation. Complete disappearance of sulphur segregation was observed when the rare earth addition was 0.05%-0.08%. A possible explanation of this segregation and the grain boundary cleaning effects of the rare earth is proposed.

120332 Microstructural characterization of doped dicalcium silicate polymorphs. A.Ghose, S.Chopra, J.F.Young (Dept. of Civil Engng. & Ceramic Engng., Univ. of Illinois, Urbana, IL, USA).
J. Mater. Sci. (GB), vol.18, no.10, p.2905-14 (Oct. 1983).
This study has shown that both β and α'-C_2S can be readily stabilized by suitable doping with BaO, B_2O_3, and P_2O_5, using a single firing at 1450°C. The β-C_2S samples all have similar lamellar structures, irrespective of the dopant present, which show (100) twinning. Grain boundary phases are present in all β-C_2S preparations. The α'-C_2S crystals usually contain precipitates and associated strain fields and dislocations, but a grain boundary phase was only observed in α'-C_2S stabilized by BaO. Some correlation between reactivity and presence of dislocations and strain fields has been suggested for the α'-C_2S phase. (22 refs.)

120333 Electron microscopic investigations on a melt-quenched Al-Rh alloy. Z.A.Chaudhury, C.Suryanarayana (Dept. of Metall. Engng., Banaras Hindu Univ., Varanasi, India).
J. Mater. Sci. (GB), vol.18, no.10, p.3011-22 (Oct. 1983).
An Al-2wt% Rh alloy was subjected to rapid quenching from the molten state and transmission electron microscopy and diffraction techniques were extensively used to characterize the phases present. Melt quenching led to the formation of a homogeneous solid solution indicating a substantial increase in solid solubility limit over the equilibrium value. Although stable up to about 640K, the supersaturated solid solution decomposed at elevated temperatures to a mixture of aluminium solid solution and an intermediate phase, which has been identified to have a monoclinic structure with $a=1.636$ nm, $b=0.805$ nm, $c=1.279$ nm and $\beta=107.77°$ with a stoichiometry corresponding to $Al_{13}Rh_4$. Although heterogeneous nucleation at grain boundaries was the predominant feature, the precipitate also formed as Widmanstatten platelets inside the grains. This phase has been shown to be an equilibrium phase. Very long annealing treatments at temperatures of 773K resulted in the formation of an ordered phase. The long-range order was destroyed on heating to still higher temperatures. The equilibrium constitution of the alloy has been shown to be a mixture of $Al_{13}Rh_4$ and aluminium solid solution. (28 refs.)

120334 Electron microprobe analysis of phase segregation in the Heusler alloy $Cu_{2.00}Mn_{1.00}Al_{1.00}$. R.Kozubski, J.Soltys (Inst. of Phys., Jagellonian Univ., Krakow, Poland), R.Kuziak.
J. Mater. Sci. (GB), vol.18, no.10, p.3079-86 (Oct. 1983).
Aged specimens of the alloy $Cu_{2.00}Mn_{1.00}Al_{1.00}$ were examined by means of the ARL scanning electron microprobe quantometer. The process of segregation of the components was observed and the precipitates were identified with the phases detected previously by means of X-ray diffraction. The observed evolution of microstructures and the results of X-ray diffraction and magnetometric measurements were the basis of the description of the process of the decomposition of β-phase of the system Cu-Mn-Al at temperatures below 973K. Considerable difference between the microstructures of the alloy annealed below and above 700K confirmed the previously indicated existence of a critical point localized between 673 and 723K. (18 refs.)

120335 Microanalytical investigation of sintered SiC. II. Study of the grain boundaries of sintered SiC by high resolution Auger electron spectroscopy. R.Hamminger, G.Grathwohl, F.Thummler (Univ. Karlsruhe, Karlsruhe, Germany).
J. Mater. Sci. (GB), vol.18, no.10, p.3154-60 (Oct. 1983).
For pt.I see ibid., vol.18, p.353 (1983). UHV-fracture surfaces of different (B, C)- and (Al, C)-doped pressureless sintered SiC materials are investigated by using high resolution Auger electron spectroscopy (HRAES). The grain boundaries at intergranular fractured regions of (B, C)-doped materials are evidently free of any enrichment of impurity elements or sintering additives. In contrast, the (Al, C)-doped materials reveal the existence of thin Al-containing grain boundary films. Sputtering indicates their thickness to be less than 1 nm. The concentrations of the elements segregated in the grain boundary films are determined. (14 refs.)

120336 Precipitation and solid solubility in the system $NiO-Cr_2O_3$. C.-H.Chen, M.R.Notis, D.B.Williams (Dept. of Metall. & Materials Engng., Lehigh Univ., Bethlehem, PA, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.566-71 (Aug. 1983).
The precipitation of $NiCr_2O_4$ and the solid solubility of Cr^{3+} in NiO were investigated. Homogeneous precipitation occurs in this system, and the decomposition of $NiO-Cr_2O_3$ solid solution involves only one stable equilibrium phase, $NiCr_2O_4$. The small lattice misfit between precipitate and matrix results in the formation of randomly distributed spherical precipitates about 3 to 10 nm in diameter in the initial stage of growth. Above that size, precipitates form as ellipsoidal plates lying on $\{100\}$ with all directions of the precipitate and matrix mutually parallel. Strain-energy effects provide a rational explanation for the observed precipitate morphology during nucleation and subsequent growth. The precipitates grow along $\langle 100\rangle$ to a size at which coherency is no longer maintained. The loss of coherency is associated with the development of interfacial dislocations, and the critical size at which coherency is lost is ≈300 nm. Dissolution of coherent precipitates and growth of semicoherent precipitates was directly observed to occur simultaneously when both are present. (22 refs.)

120337 Intergranular segregation studies in steels using STEM-EDS X-ray microanalysis. P.Doig, P.E.J.Flewitt (South Eastern Region, Sci. Services Dept., CEGB, Gravesend, England).
J. Microsc. & Spectrosc. Electron. (France), vol.8, no.3, p.193-210 (1983). (Meeting of the French and Belgian Societies for Electron Microscopy, Liege, Belgium, 16-19 May 1983).
Results are described for STEM-EDS X-ray microanalysis of equilibrium and nonequilibrium solute segregations to prior austenite grain boundaries in a range of ferritic steels typically used in electrical power generating plants. Consideration is given to the requirements and limitations of the microanalysis technique. Examples have been selected which demonstrate the various solute profiles and distributions which may develop for various heat treatment and alloy compositions. (27 refs.)

120338 Formation of etch boundaries at the interface of Mo grains and a liquid Ni-Fe matrix during cyclic annealing. Sung Soo Kim, D.N.Yoon (Dept. of Materials Sci., Korea Advanced Inst. of Sci. & Technol., Seoul, Korea).
Metallography (USA), vol.16, no.3, p.249-53 (Sept. 1983).
Describes direct observations of the grain-coarsening process with cyclic annealing treatment. The specimens of 85 wt.% Mo-13.5 wt.% Ni-1.5 wt.% Fe were prepared from powders about 5 μm in size by powder metallurgy techniques. The growth pattern of the isolated grains was shown to be nearly concentric, in agreement with the usual assumptions made in the theories of Ostwald ripening. (9 refs.)

120339 An AEM investigation of the formation of precipitate-free zones in an Al-16 wt.% Ag alloy: determination of equilibrium and metastable solvus lines. S.M.Merchant, M.R.Notis, D.B.Williams (Dept. of Metall. & Materials Engng., Lehigh Univ., Bethlehem, PA, USA).
Metall. Trans. A (USA), vol.14A, no.9, p,1825-31 (Sept. 1983).
Precipitation of the equilibrium γ-phase at grain boundaries in an aged Al-16 wt.% (∼4.5 at.%) Ag alloy is responsible for the formation of a solute depleted region, free of metastable Guinier-Preston (GP) zones, in the immediate vicinity of the grain boundary. Solute concentration profiles have been obtained across these grain boundary regions using analytical electron microscopy (AEM) in thin foils of the alloy aged at low temperatures. The Ag concentrations at the grain boundary (between γ precipitates) and at the edge

of the precipitate-free zone have been used to determine the solid solubility of Ag in Al (the $\alpha/\alpha(\alpha+\gamma)$ solvus) and the metastable GP zone solvus line, respectively. (36 refs.)

120340 On the size-shape relation of Guinier-Preston zones and α_R'-precipitates in an Al-6.8 at.% Zn alloy. R.Ramlau, H.Loffler (Sektion Math./Phys., Padagogischen Hochschule Halle, Halle, Germany).
Phys. Status Solidi a (Germany), vol.79, no.1, p.141-8 (Sept. 1983).
Ellipsoidal Guinier-Preston zones and lenticular precipitates of the α_R'-phase grown at 120°C in an Al-6.8 Zn at.% alloy are examined by means of transmission electron microscopy. For each particle two characteristic lengths are determined and the corresponding two-dimensional histograms are established. It can be shown that the precipitates monotonically flatten with increasing size. Hence, the size-shape relation did not provide any indication of the phase transition. (14 refs.)

Investigations on demixing and crystallization behaviour of metallic glasses of the system palladium-nickel-phosphorus .... See Entry 118900

Kinetics of radiation-induced segregation in Ni-12.7 at.% Si .... See Entry 119073

Solution of the coalescence kinetics problem after Ostwald ... See Entry 119202

Phase composition and phase stability of a high-chromium nickel-based superalloy, IN939 .... See Entry 120311

Long-term ageing characteristics of Hastelloy alloy X .... See Entry 120341

Ageing of austenitic iron alloys containing nitrogen .... See Entry 120353

Isotope method detecting the hydride phase in palladium saturated with hydrogen .... See Entry 120523

81.40 TREATMENT OF MATERIALS AND ITS EFFECTS ON MICROSTRUCTURES AND PROPERTIES

Temperature effect on domain structurization in segmented polyurethanes .... See Entry 118922

Effects of Cr_2O_3 additions on the sintering and mechanical properties of Al_2O_3 .... See Entry 120288

Pretreatment for the electrolytic coating of super-alloys .... See Entry 120501

81.40C Solid solution hardening, precipitation hardening, dispersion hardening

120341 Long-term ageing characteristics of Hastelloy alloy X. H.M.Tawancy (Cabot Corp., Kokomo, IN, USA).
J. Mater. Sci. (GB), vol.18, no.10, p.2976-86 (Oct. 1983).
Transmission electron microscopy and diffraction were used to characterize the microstructural changes which occur in Hastelloy alloy X after long-term ageing (up to 16000 h) at various temperatures in the range 540 to 870°C. The corresponding effects on mechanical properties were determined. It was found that the alloy age hardens at temperatures in the range of 650 to 870°C. Overageing occurred at 760 and 870°C. Marked reductions in room-temperature tensile elongation were observed after ageing at all the temperatures investigated. However, in no case was the elongation reduced to less than 15 to 30%. Also the tensile elongation at temperatures corresponding to the respective ageing temperatures was unaffected by 16000 h ageing at a temperature. It was concluded that the above effects were associated with precipitation of various phases, such as carbides, sigma- and mu-phases, in the matrix and at the grain boundaries. (11 refs.)

120342 Enhanced age hardening of 7075 aluminum alloy after ultrasonic vibration. M.M.Shea (Metall. Dept., General Motors Res. Labs., Warren, MI, USA), B.V.N.Rao.
Mater. Sci. & Eng. (Switzerland), vol.61, no.1, p.67-77 (Oct. 1983).
The influence of ultrasonic vibration (40 kHz; $\epsilon = \pm 6.4 \times 10^{-5}$) at 5°C on the hardening behavior of commercial grade 7075 aluminum alloy during aging at 120°C was investigated. Compared with the corresponding values for univibarted material, vibration increased the hardening kinetics and resulted in higher hardness at the peak-aged condition. The main effect of vibration occurred during the initial stag of ageing where Guinier-Preston (GP) zones determine the hardening behavior. The results support the hypothesis that vibration increases GP zone nucleation, resulting in a higher volume fraction of zones early in the aging process. Zone growth during this period was unaffected by vibration. The hypothesis of more zone nucleation is consistent with the observed distinct plateau region in hardness due to the relief of solute supersaturation required for zone formation. The plateau region represents an incubation period for nucleation of η' during which GP zones become ordered. Although the sequence of precipitation was unaltered by vibration, after aging for 24 h, the zone diameter and η' size were smaller in specimens which had been vibrated than in normally processed specimens. (26 refs.)

120343 Weld microstructure of $(Ni,Fe)_3(V,Ti)$ long-range-ordered alloy. D.N.Braski, S.A.David (Metals & Ceramics Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Metall. Trans. A (USA), vol.14A, no.9, p.1785-91 (Sept. 1983).
The microstructure of gas tungsten arc (GTA) welds of a $(Ni,Fe)_3(V,Ti)$ long-range-ordered alloy has been investigated. Crack-free welds were produced in which the heat affected zone (HAZ) and fusion zone were disordered and softened. A post-weld heat treatment increased the hardness of both zones by reordering the structure. The reordering treatment produced additional hardening in the fusion zone due to precipitation of small VC particles on grain boundaries and matrix dislocations. (5 refs.)

120344 Neutron small angle scattering on ZrO_2 particles in platinum 10 rhodium. D.Schwahn (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany), G.Hammer.
Z. Metallkd. (Germany), vol.74, no.9, p.598-602 (Sept. 1983). In German.
ZrO_2 particles in a PtRh solid solution alloy were investigated with neutron scattering in order to determine the influence of oxidation and high temperature annealing on the particle size and density. It was shown that the particles have a bimodal size distribution with average diameters independent of applied oxidation times and temperatures. After annealing at 1400°C for 1000 h, the particles grew to more than twice their original size. (11 refs.)

Mechanical properties of Sn-Ag_3Sn alloys .... See Entry 120320

Structure and properties of a rapidly quenched commercial Al-Mn alloy .... See Entry 120361

Viscoelastic and plastic relaxation of residual stresses around macroparticle reinforcements in metal matrices .... See Entry 120369

81.40E Cold working, work hardening; annealing, recovery and recrystallisation; textures

120345 The use of a quadratic form for the determination of non-negative texture functions. P.Van Houtte (Dept. Metaalkunde, Katholieke Univ. Leuven, Leuven, Belgium).
Textures & Microstruct. (GB), vol.6, no.1, p.1-20 (1983).
The classical analysis of measured pole figures of textured polycrystals by the series expansion method does not necessarily produce a non-negative texture function. The main reason for this is, that the method is unable to find the terms of odd rank l of the series expansion. A new method is proposed, which introduces the non-negativity condition into the series expansion method by the use of quadratic forms. The method is found to be successful when treating sharp textures, which have a considerable zero range in Euler space. The preliminary determination of this zero range by experimental methods is however not necessary. (12 refs.)

120346 Texture and cleavage in molybdenum. P.I.Welch (Inst. fur Metall., Tech. Univ. Clausthal, Clausthal-Zellerfeld, Germany), G.J.Davies.
Textures & Microstruct. (GB), vol.6, no.1, p.21-37 (1983).
It is of considerable technological importance to establish how far textures introduced into controlled-rolled steels by finish rolling at low temperatures may affect the fracture strength. The purely textural effect is difficult to isolate in such steels because of anisotropy associated with grain shape, inclusions and pearlite banding. Consequently, an investigation was carried out using molybdenum, a b.c.c. single phase material showing good structural homogeneity, as a model. Texture development was studied using crystallite orientation distribution function analysis to identify a suitable processing route leading to a sharp texture with a suitable distribution of $\{100\}$ cleavage planes. The behaviour of a sharply textured specimen was analysed by taking fracture specimens from various orientations in the plate. The energy absorbed in impact showed a positive correlation with the density of 100 planes in the crack direction, but the extent of the variation was less than would have been expected had crack propagation been the controlling step in the fracture process. (26 refs.)

120347 Shear bands and the development of the brass annealing texture. T.Ozturk (Dept. of Metall. Engng., Middle East Tech. Univ., Ankara, Turkey).
Textures & Microstruct. (GB), vol.6, no.1, p.39-43 (1983).
Shows experimentally that the contention that the brass annealing texture originates from recrystallization within shear bands does not necessarily contradict the oriented-growth theory, since a growth selection process similar to that postulated to occur in the matrix could occur within the bands. Nevertheless the nature of the present observation is more in accordance with the oriented-nucleation concept. In this sense, therefore there exists a strong indication that the brass annealing texture has its origin in the nature of the deformed microstructure which has evolved by simple shear. (12 refs.)

120348 The determination of crystallographic textures from selected areas of a specimen by electron diffraction. F.J.Humphreys (Dept. of Metall. & Materials, Imperial Coll., London, England).
Textures & Microstruct. (GB), vol.6, no.1, p.45-61 (1983).
A technique for the determination of partial pole figures with an angular resolution of $<3°$, from selected areas of a thin foil, is described. A microcomputer, interfaced to an unmodified JEOL 100 CX TEMSCAN electron microscope is used to scan a diffraction pattern over a detector, tilt the specimen in steps of 1.5° over a range of $\pm 50°$, and plot the resulting data as a semiquantitative pole figure. The application of the technique to the study of materials which deform inhomogeneously is discussed, and examples are given of pole figures obtained from deformed single phase and two phase aluminium specimens. (5 refs.)

120349 Deformation and recrystallisation textures of polycrystalline nickel. J.Pospiech, J.Jura (Inst. for Metal Res., Polish Acad. of Sci., Cracow, Poland), A.Mucklich, K.Pawlik, M.Betzl.
Textures & Microstruct. (GB), vol.6, no.1, p.63-79 (1983).
The development has been analysed of the primary recrystallisation texture in samples of polycrystalline nickel rolled to various degrees of reduction. A great similarity between the texture characteristics of copper and nickel has been found. Regularities of cube texture development were established and compared with results of texture and microstructure investigations obtained by other authors. (20 refs.)

120350 Can inherited textures in the BCC phase furnish information about the type of transformation from the FCC phase?. V.Jung (Kernforschungszentrum Karlsruhe, Inst. fur Angewandte Kernphys. I, Karlsruhe, Germany).
J. Appl. Crystallogr. (Denmark), vol.16, pt.5, p.535-41 (1 Oct. 1983).
Stretching annealed cylindrical 18/8 Cr-Ni steels produces transformed HCP and BCC phases, both showing major textural contributions with increasing stretching of the cylindrical specimens. After stretching, the original FCC phase shows two orientations: $[100]_{FCC} \|$ cylinder axis and $[111]_{FCC} \|$ cylinder axis, i.e. direction of stress. In both cases, the martensitic phase is produced by slipping and shear in the FCC→HCP→BCC sequence by Nishiyama-Wasserman (N-W) or Kurdjumov-Sachs (K-S) transformations in the $(111)_{FCC}$ planes, which enclose angles $\neq 0.90°$ with the direction of stress, i.e. the cylinder axis. The orientation distributions of the $(100)_{BCC}$ reflexion, calculated by means of a very simple model, are compared with the distribution measured by neutron diffraction to obtain information on the bulk material. The special K-S transformation with only six $(110)_{BCC}$ orientations in the ω scan together with the special N-W transformation with six orientations in the ω scan show relatively good agreement with the measured distribution. Both transformation processes are based on continuous tilting of the newly formed $(110)_{BCC}$ places in the direction of the cylinder axis during the deformation process. (9 refs.)

The effect of annealing on the defect structure and electrical properties of deformed single crystals of Ge .... See Entry 119019

The influence of cold-working on magnetic properties in Ni_3Al .... See Entry 119889

Influence of nonsteady state behavior on superplastic deformation of a 25.7 Cr-6.6 Ni stainless steel .... See Entry 120378

Factors influencing the susceptibility to intergranular attack, stress corrosion cracking and de-alloying attack of aluminium brass .... See Entry 120486

Corrosion cracking phenomena under different polarizing and microstructural conditions in a 304 stainless steel tested in low temperature acid solutions .... See Entry 120494

Magnetic structure analysis .... See Entry 120545

81.40G Other heat and thermomechanical treatments

120351 Influence of cold hydropressing conditions on the density of tool steels. B.I.Beresnev, V.Z.Spuskanyuk, G.O.Lyads'ka, V.A.Bogdanov, R.M.Lappa, A.I.Mel'nickenko, M.L.Sokolov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.9, p.78-82 (1983). In Ukrainian.
Deals with the influence of cold hydropressing on the density and mechanical properties of tool steels. It is shown that material loosening is characterized by the stale composition and deformation condition, of the material. There exists a limiting deformation above which the negative influence of defects such as micropores and microcracks due to deformation prevails over the positive influence of structural changes giving rise to improvement in mechanical properties of the material after final heat treatment. When at cold hydroprocessing backpressure is imposed, this makes it possible to slow down a decrease in density of the material and to increase the operating characteristics of products. (8 refs.)

120352 The morphology of martensite in Fe-C, Fe-Ni-C and Fe-Cr-C alloys. M.Umemoto, E.Yoshitake, I.Tamura (Dept. of Metal Sci. & Technol., Kyoto Univ., Kyoto, Japan).
J. Mater. Sci. (GB), vol.18, no.10, p.2893-904 (Oct. 1983).
The morphology of martensite in widely varying series of FE-C, Fe-Ni-C and Fe-Cr-C alloys was investigated using optical microscopy. The effects of formation temperature and alloying elements on the martensite morphology were studied in detail. It was found that in Fe-C alloys, lath martensite forms in alloys with less than 0.8 wt% carbon, butterfly martensite forms in alloys with between 0.98 and 1.42 wt% carbon and lenticular martensite forms in alloys with more than 1.56 wt% carbon. In Fe-Ni-C alloys, four different martensite morphologies form depending upon the formation temperature and composition, and for alloys of a fixed carbon content the martensite morphology changes from lath to butterfly to lenticular to thin plate as the formation temperature is decreased. In Fe-Cr-C alloys, lath martensite forms at high temperature, and below the lath formation temperature mainly $\{225\}_f$ plate martensite is formed. (32 refs.)

120353 Ageing of austenitic iron alloys containing nitrogen. P.Ferguson, J.H.Driver, A.Hendry (Wolfson Res. Group for High-Strength Materials, Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
J. Mater. Sci. (GB), vol.18, no.10, p.2951-6 (Oct. 1983).
The Lifshitz-Wagner theory of coarsening (1961) applied to the experimental data for titanium and vanadium nitride precipitates in austenitic iron-nickel steels shows that Ostwald ripening is controlled by diffusion of the substitutional titanium or vanadium solute atoms. The influence of oxygen impurity is shown to modify both the VN coarsening behaviour and growth morphology. (21 refs.)

120354 The influence of thermal history on the microstructure of sulfonated polystyrene ionomers. R.A.Weiss, J.Lefelat, H.Toriumi (Univ. of Connecticut, Storrs, CT, USA).
J. Polym. Sci. Polym. Lett. Ed. (USA), vol.21, no.8, p.661-7 (Aug. 1983).
A recent article reported on the thermal behavior of several sulfonated polystyrene ionomers aged for up to 8 months at room temperature after being cooled from the melt. By using differential scanning calorimetry (DSC) the authors observed in the thermograms of these materials an anomalous endothermic event below T_g, and the intensity of this endotherm was a function of aging time and sulfonate concentration. The endotherm may represent the relaxation of strain energy that develops from internal stressing of the polymer chains as the sulfonate groups diffuse into more favored conformations, e.g., ionic clusters. The presence of ionic clusters in these ionomers has been confirmed recently by small-angle X-ray scattering (SAXS). The authors report on some SAXS studies that lend support to their hypothesis of a time and temperature dependence of the microphase separation in these materials. In addition, they describe some preliminary electron spin resonances (ESR) studies of these ionomers that demonstrate a strong dependence of the cation-cation interaction on the thermal history of the ionomer. (8 refs.)

120355 A TEM study of microstructural changes during retrogression and reaging in 7075 aluminum. Nguyen Cong Danh, K.Rajan, W.Wallace (Nat. Aeronaut. Establ., Nat. Res. Council Canada, Ottawa, Ontario, Canada).
Metall. Trans. A (USA), vol.14A, no.9, p.1843-50 (Sept. 1983).
Microstructural changes occurring during retrogression, and during retrogression plus reaging in 7075-T6 aluminum alloy have been investigated by means of transmission electron microscopy, and related to mechanical properties. TEM results indicate that the drop in strength during the initial stage of retrogression was due to the partial dissolution of GP zones while the growth of the semi- coherent ϵ' was responsible for the rapid recovery of strength. It is suggested that the retrogression and reaging treatment resulted in the increase in volume fraction of GP zones and especially η' precipitates over both the T6 and retrogressed conditions, therefore significantly improving the strength of the alloy. (21 refs.)

120356 Ergoterm SBT—an antimony stabilizer for rigid PVC compounds. B.Wojtowicz, B.Kawinska, I.Tomaszewska (Inst. Chem. Przemyslowej, Warsaw, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.4, p.123-6 (April 1983). In Polish. [received: Oct. 1983]
The results of studies on the thermal and natural ageing stability as well as on the processing properties of rigid, transparent PVC-S compounds have been presented. These compounds have been stabilized with Ergoterm SBT, a Polish-made antimony stabilizer. The possibility of using this stabilizer in the manufacture of some rigid items from PVC, instead of the more expensive Ergoterm OTGO organotin stabilizer, has been confirmed. The stabilizing system composed of Ergoterm SBT and Ergoplast ES revealed to be the most advantageous one for this type of rigid PVC compounds. (3 refs.)

120357 The properties of equimolar copolycarbonates of bisphenol A with bisphenol S and 1,4-bis(hydroxymethyl)cyclohexane. M.Yenigul, I.W.Parsons, J.N.Hay, R.N.Haward (Dept. of Chem., Univ. of Birmingham, Birmingham, England).
Polymer (GB), vol.24, no.10, p.1313-16 (Oct. 1983).
Ranges of both alternating and random 1:1 copolycarbonates of bisphenol-A (2,2-bis(4-hydroxyphenyl)propane) and bisphenol-S (4,4'-dihydroxydiphenyl sulphone) and of bisphenol-A and 1,4-dimethanoylcyclohexane have been synthesized in order to test the hypothesis that, other things being equal, a more random structured polymer should exhibit superior thermal ageing characteristics. Studies on these materials' mechanical and thermal properties establish that within each pair they are extremely similar and hence the original hypothesis is disproved. (10 refs.)

120358 Upper-bound analysis of hot extrusion of axisymmetric rods and tubes. II. Hot extrusion of tubes. C.Teodosiu, I.Rosu, T.Dumitrescu (Dept. of Solid Mech., Inst. for the Phys. & Technol. of Materials, Bucharest, Rumania).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.4, p.395-411 (July-Aug. 1983).
For pt.I see ibid., vol.28, no.3, p.317 (1983). Part I was devoted to the mathematic modelling of hot extrusion by assuming an arbitrary stationary streamline pattern and taking into account the non-stationarity of the thermal field. This second part is concerned with the comparison between the upper-bound solutions obtained by using various streamline models for the hot extrusion of axisymmetric tubes. (no refs.)

120359 Electron microscopy observation and X-ray microanalysis of aged martensites in a Cu-12.9 mass% Al-2.5 mass% Mn shape memory alloy. H.Kubo, A.Miyake, K.Shimizu (Inst. of Sci. & Industrial Res., Osaka Univ., Osaka, Japan).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.9, p.603-12 (Sept. 1983).
Aged martensites in a Cu-12.9 mass% Al-2.5 mass% Mn shape memory alloy have been studied by means of electron microscopy and diffraction and X-ray microanalysis. On ageing an 18R martensite at 573K, very small coherent and spherical precipitates are homogeneously formed throughout the martensite. These very small precipitates are evolved by banishing Cu atoms into the martensite matrix. In accordance with such composition variance in the martensite matrix, M and A_s temperatures increase on ageing. In connection to the formation of very small precipitates, the 18R martensite gradually varies the crystal structure to a 2H one. Plate-like precipitates are also observed in the martensite matrix at early stages of ageing, which are of a DO_3 structure and rich in Al content. Orientation relationship and habit plane of the plate-like precipitates to the martensite matrix are similar to those of thermoelastic martensites to the β_1 matrix in Cu-Al alloys. At late stages of ageing, equilibrium γ phase appears in a block shape, and the plate-like precipitates with a DO_3 structure are observed in contact with the γ phase. (23 refs.)

120360 Microstructural changes near the coherent spinodal line in the Fe-Mo alloy system. T.Kozakai, T.Miyazaki (Dept. of Metall. Engng., Nagoya Inst. of Technol., Nagoya, Japan).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.9, p.633-41 (Sept. 1983).
Microstructural changes near the coherent spinodal line during ageing in Fe-18.5 and 19.2 at.% Mo alloys were investigated by means of transmission electron microscopy. A mixed microstructure of the $\langle 100\rangle$ modulated structure and the plate-shaped Mo-rich zones was observed in the alloys aged at a temperature just above the coherent spinodal temperature, T_s. With further ageing this morphological distinction became obscure, and consequently the modulated structure appeared. When the alloy was aged at a higher temperature, the plate-shaped zones were only nucleated on the $\{100\}$ matrix planes, while the ageing at a temperature just below T_s only produced a typical $\langle 100\rangle$ modulated structure. A series of results implies that the microstructures produced near T_s become continuously inhomogeneous with increasing ageing temperature, which has been proposed by Binder. (17 refs.)

120361 Structure and properties of a rapidly quenched commercial Al-Mn alloy. M.H.Rao, G.Sridhar, C.Suryanarayana (Dept. of Metall. Engng., Banaras Hindu Univ., Varanasi, India).
Z. Metallkd. (Germany), vol.74, no.9, p.585-91 (Sept. 1983).
Microstructure and mechanical properties of a melt-quenched commercial Al-Mn alloy have been investigated. The foils obtained by the combined 'gun' and 'piston-and-anvil' method are about 100 μm thick in the centre and had a microhardness value of about 480 MPa. These foils have been annealed at different temperatures and the hardness measured as a function of time. These ageing curves showed a peak value suggesting the tendency for precipitation hardening. Annealing at 573K for 10 h resulted in a maximum hardness of 620 MPa, tensile strength of 205 MPa and 0.1% proof stress of 162 MPa for this alloy. The as-quenched foils contained only a supersaturated solid solution, which was quite stable up to about 523K. Decomposition of the supersaturated solid solution at higher temperatures led to the precipitation of intermediate phases. Electron diffraction studies have identified these phases to be $Al_6(Fe,Mn)$ and α-$Al_{12}Mn_3Si$. (29 refs.)

Effect of thermal stress on the homogeneity of optical glasses .... See Entry 118238

Crystallization of amorphous silicon nitride .... See Entry 118891

Annealing of $Hg_{1-x}Cd_xTe$: Hg loss rates and annealing of ion implantation damage .... See Entry 119040

Mechanism of solid state transformations in single crystals of $Zn_xCd_{1-x}S$ .... See Entry 119180

Effect of heat treatment on the structural characteristics and sorption properties of clinoptilolite .... See Entry 119335

Effect of conditions for producing amorphous metallic films of hypereutectic iron-boron alloy on their structure .... See Entry 119377

Effect of ageing heat treatment on the magnetic behaviour of a gold-iron alloy .... See Entry 119826

On the coercive field of the nearly non-magnetostrictive amorphous ferromagnetic alloy $Co_{58}Ni_{10}Fe_5Si_{11}B_{16}$ .... See Entry 119871

High coercive force 2-17-type $Sm_{1-x}Er_x(Co_{0.69}Fe_{0.22}Cu_{0.08}Zr_{0.02})_{7.22}$ magnets with a low temperature coefficient .... See Entry 119873

Defect recovery and trapping in plastically deformed Au studied by perturbed angular correlations of ^{111}In .... See Entry 119964

Comparison of fast electron and thermal annealing of proton bombarded silicon-X-ray and IR spectroscopy study .... See Entry 120083

Optical properties of laser-melt-quenched Au-Si alloys .... See Entry 120173

Characterization of thin Nb_3Sn diffusion layers on Nb (110): low-energy electron-diffraction and photoemission studies .... See Entry 120220

Thermostable material from fluorophlogopite and an organosilicon binder .... See Entry 120292

Phase composition and phase stability of a high-chromium nickel-based superalloy, IN939 .... See Entry 120311

Single crystal neutron diffraction study of the long-range order in Cu_2NiZn .... See Entry 120328

Weld microstructure of $(Ni,Fe)_3(V,Ti)$ long-range-ordered alloy .... See Entry 120343

Neutron small angle scattering on ZrO_2 particles in platinum 10 rhodium .... See Entry 120344

A high performance wrought nickel-base superalloy EI-929 .... See Entry 120372

Microstructure and mechanical properties of Zn-Al alloys at room temperature .... See Entry 120379

The effect of physical ageing on the properties of poly(ethylene terephthalate) .... See Entry 120381

High-temperature thermoviscoelasticity of drawn poly(ethylene terephthalate) .... See Entry 120392

The nature of quasicleavage fracture in tempered 5.5Ni steel after hydrogen charging .... See Entry 120419

Fracture toughness and fatigue behavior of Matrix II and M-2 high speed steels .... See Entry 120420

The effects of heat treatment on fracture toughness and fatigue crack growth rates in 440C and BG42 steels .... See Entry 120421

Magnetic structure analysis .... See Entry 120545

81.40J Elasticity and anelasticity

(see also 62.20D Elastic constants, 62.40 Anelasticity, internal friction, and mechanical resonances)

120362 Anelasticity and viscoplasticity in metallic glasses. J.Haimovich, T.Egami (Dept. of Materials Sci. & Engng., Univ. of Pennsylvania, Philadelphia, PA, USA).
Mater. Sci. & Eng. (Switzerland), vol.61, no.1, p.89-98 (Oct. 1983).
Low level constant-load tensile creep measurements and bend stress relaxation measurements were made on the metallic glasses $Fe_{40}Ni_{40}B_{20}$ and $Fe_{32}Ni_{36}Cr_{14}P_{12}B_6$ at various temperatures. The anelastic (recoverable) and viscoplastic (non-recoverable) components of flow were separated using pre-annealing treatments of various lengths of time, and multiple stress reversals for bend stress relaxation. The influence of the structural relaxation on the anelasticity was studied by continuous measurements of apparent viscosity. It was found that, while viscoplastic deformation drastically decreases with annealing, the anelastic behaviour is only weakly affected. The viscosity versus time curves for pre-annealed samples are shifted on the time axis with respect to those for as-quenched samples. The relaxation rates calculated from the final stages of stress relaxation are higher than those estimated for pre-annealing periods. All these findings strongly imply that the spectrum of activation energies for anelastic relaxation is very broad and little affected by thermal treatments. (24 refs.)

120363 Analysis of mechanical relaxation processes in materials based on heat-resistant polymers. Z.S.Vikhauskas, R.V.Banyavichyus, A.I.Marma, A.A.Askadskii (Antanas Snechkus Kaunas Polytech. Inst., USSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.745-9 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.1090-5 (Nov.-Dec. 1982). [received: Sept. 1983]
A detailed analysis of the relaxation behavior of polyoxadiazole and polyimide, promising materials for the manufacture of heat-resistant composite systems, was carried out. It is demonstrated that a relatively small set of experiments on isothermal and nonisothermal stress relaxation is sufficient to be able to assess the parameters of the relaxation processes. The mathematical expressions that correlate the relaxation processes at different stress conditions have been confirmed experimentally and can be used to predict the viscoelastic behavior of heat-resistant materials. (13 refs.)

120364 Matrix dominated properties of high performance composites. P.Yang, C.Altman, D.Taggart, L.Carlsson, S.S.Sternstein (Dept. of Materials Engng., Rensselaer Polytech. Inst., Troy, NY, USA).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.25/1-6
The out of plane mechanical properties of high performance laminates are governed by the matrix behavior. An out of plane centro-symmetric deformation test is described which is quite sensitive to matrix properties. The small strain viscoelastic properties are shown to be independent of stacking sequence and obey time-temperature superposition around the matrix glass transition. The delamination properties are shown to be dependent on stacking sequence. (6 refs.)

120365 Dynamic bulk and shear relaxations in solid polymers: relationship to deformation behavior. A.F.Yee.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.32/1-7
Dynamic bulk and shear relaxation are predictd to reduce the bulk (crazing) and shear yield stresses, respectively. Data are presented for PMMA, slow-cooled and quenched PC, and piperidine cured DGEBA epoxy. Bulk relaxation peaks of various magnitudes are found for each of the materials. Good correlation is found between the location of these bulk relaxations and low fracture toughness. (24 refs.)

120366 Thermodynamic aspects of mechanical behavior of glassy polymers. J.Moacanin, S.T.J.Peng, A.Gupta, R.F.Landel (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.34/1-6
Recent volume recovery and stress relaxation measurements were successfully interpreted in terms of free-volume fractions calculated from a theoretical equation of state of Simha and Somcynsky (see Macromolecules, vol.2, p.342, 1969). The authors were able to determine independently these free-volume fractions using ESR to measure mobility of spin probes. Inasmuch as the theoretical equation of state is derived from considerations of molecular mobility in the context of the cell theory of the solid state, these results suggest a new experimental approach toward extending the thermodynamic description of the polymer glassy state. (15 refs.)

A study on GRP skin/foam core sandwich structures .... See Entry 118413

Calculation of the elastic characteristics of a unidirectional fiber composite by the cross-section method .... See Entry 118419

Use of nonlinear models of viscoelasticity in the investigation of the effect of hydrostatic pressure on the shear creep of polymeric materials .... See Entry 118440

On the transverse vibration of a rubber string .... See Entry 118476

Stress redistribution in a ruptured fiber of a viscoelastic composite .... See Entry 118516

High-temperature internal friction peaks of pure aluminium .... See Entry 119100

The magnetic and magnetoelastic properties of amorphous metallic ribbons .... See Entry 119891

Orientation and relaxation in uniaxially stretched atactic polystyrene .... See Entry 120020

Mechanical characterization of sheet molding compound composites .... See Entry 120367

Viscoelastic and plastic relaxation of residual stresses around macroparticle reinforcements in metal matrices .... See Entry 120369

The mechanical properties of cellular solids .... See Entry 120377

Theory of pseudo cross-link. III. Rheological behavior .... See Entry 120385

Tensile and flexural properties of fibers of an extended chain polymer .... See Entry 120390

The influence of branch length on the deformation and microstructure of polyethylene .... See Entry 120395

On the stress distribution in ceramo-metallic composite beams and the occurrence of transverse cracks in the ceramic overlay .... See Entry 120397

Fracture toughness of fibre reinforced composite materials .... See Entry 120417

Effect of low-cycle loading on the mechanical characteristics and structure of unidirectional organoplastic .... See Entry 120425

Deformation and fracture of polydiacetylene single crystal fibres .... See Entry 120431

Correlations of the dry crazing resistance of glassy polymers with other physical properties .... See Entry 120460

Effects of water on glass-filled methacrylate resins .... See Entry 120468

Mechanical properties of the crazes in glassy polymers .... See Entry 120482

81.40L Deformation, plasticity and creep

(see also 62.20F Deformation and plasticity, 62.20H Creep)

120367 Mechanical characterization of sheet molding compound composites. S.K.Chaturvedi, C.T.Sun, R.L.Sierakowski (Dept. of Engng. Sci., Univ. of Florida, Gainesville, FL, USA).
Polym. Compos. (USA), vol.4, no.3, p.167-71 (July 1983).
A study was conducted to determine basic mechanical property characterization of five different sheet molding compound (SMC) materials with glass content varying from 30 to 65 percent by weight. In particular, the objectives were to find variation in their tensile, flexural, and shear properties along with some information on fabrication-induced anisotropy that may be present in these materials. The flexural properties were measured using three-point bend tests, and double-rail shear tests were conducted for in-plane shear properties. A significant scatter was observed in all the properties, and no conclusive evidence about the fabrication-induced anisotropy was found. Flexural strength of each material was found to be significantly greater than the tensile strength. Finally, some interesting features associated with their tensile and flexural failure models have also been discussed. (7 refs.)

120368 Variability in static strengths of sheet molding compounds (SMC). C.D.Shirrell (Polymers Dept., General Motors Res. Labs., Warren, MI, USA).
Polym. Compos. (USA), vol.4, no.3, p.172-9 (July 1983).
The variability in the strengths of six glass fibre-reinforced sheet molding compounds (SMC) is reported. This variability was shown not to be caused by macroscopic variations in fiber, resin, filler, or void content nor gross fiber anisotropy. Weibull statistics were used to accurately characterize this variability. Random flaw models with the flaws being distributed in the volume, surface, or edge were shown not to predict the observed static strength variability in SMC. (9 refs.)

120369 Viscoelastic and plastic relaxation of residual stresses around macroparticle reinforcements in metal matrices. P.J.Fritz, R.A.Queeney (Dept. of Engng. Sci. & Mech., Pennsylvania State Univ., University Park, PA, USA).
Composites (GB), vol.14, no.4, p.393-4 (Oct. 1983).
Equations are presented for the calculation of residual stresses generated by temperature changes in metal matrix composites. The interfacial contact pressures and plastic zone sizes for various cooling rates imposed on an Al_2O_3 sphere embedded in 355 aluminium are evaluated. The results show that stress relaxation and alloy viscosity are important factors affecting the final composite residual stress state. (8 refs.)

120370 Diffraction-contrast study of microstructure and deformation process of WC-Co cemented carbide. Lui Manlang, Huang Xiaoying, Duan Shitian, Shao Daqin, Cui Yumei, Yao Zhenmei (Central Iron & Steel Res. Inst., Min. of Metall. Industry, Beijing, China).
Int. J. Refract. & Hard Met. (GB), vol.2, no.3, p.129-32 (Sept. 1983).
The diffraction-contrast study was carried out on the commercially produced WC-12%Co cemented carbides by TEM. According to the observation of two-phase microstructure, the phase transformation process of binder in the alloy was investigated and the experiment evidences for the transformation of β-Co to stacking faults to ϵ-Co were obtained. Finally, one possible explanation was advanced for the deformation of the alloy and the propagation process of cracks. (5 refs.)

120371 Influence of the plastic deformation conditions under pressure on the structure and properties of Mo. B.I.Beresnev, V.Z.Spuskanyuk, B.M.Efros, N.B.Shishkova, G.V.Dolgikh.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.79-82 (1983). In Ukrainian.
Optical and electron microscopic methods were used to study the strength properties and structure variations in low-alloyed molybdenum deformed under pressure by different hydroextrusion methods. It is shown that pressure, temperature and velocity changes of extrusion with identical degree of deformation specify the peculiarities of the substructure and the level of microhardness obtained depending on conditions of plastic deformation under pressure. (6 refs.)

120372 A high performance wrought nickel-base superalloy EI-929. K.K.Sharma, S.N.Tewari (Defence Metall. Res. Lab., Hyderabad, India).
J. Mater. Sci. (GB), vol.18, no.10, p.2915-22 (Oct. 1983).
EI-929, a high peformance Soviet nickel-base wrought superalloy having the composition, Ni-14Co-10Cr-5W-4Mo-4Al-2Ti-0.5V-0.1C-0.02B (wt%) was prepared by vacuum induction melting and vacuum arc refining. The ingots were homogenized and hammer forged. The microstructural inhomogeneities in the forged product were examined. Tensile and stress-rupture properties, and fracture behaviour were observed to vary between the central and the outer portion of the forged stock. (5 refs.)

120373 Creep of Kevlar 49 fibre and a Kevlar 49-cement composite. P.L.Walton, A.J.Majumdar (Dept. of the Environment Building Res. Station, Garston, Watford, England).
J. Mater. Sci. (GB), vol.18, no.10, p.2939-46 (Oct. 1983).
The creep strain responses of Kevlar 49 fibres and a Kevlar 49-cement mortar composite board to sustained stresses have been studied over an extended period in excess of four years at ambient temperature. Single filaments of Kevlar 49900 mm in length, were stressed in tension in the range 830 to 1830 MPa. The relationship between creep and elapsed time is represented by the power function At^n where A is a function of stress and n is a constant. The

creep strain in Kevlar 49 was low compared with other polymers. For example after 1000 days at a stress of 1830 MPa the creep strain was 13% of the initial elastic strain and is predicted by the power function to increase to 14.6% after 4000 days. The Kevlar 49-mortar composite was subjected to bending stresses in the range 6 to 35 MPa and the creep deflection was monitored. (16 refs.)

120374 High temperature compressive behaviour of as-cast Al-Cu alloys of varying composition. G.A.Nassef, M.Suery (Lab. de Genie Physique et Mecanique des Materiaux, INPG-IEG, Domaine Univ., Saint-Martin-d'Heres, France).
J. Mater. Sci. (GB), vol.18, no.10, p.3031-40 (Oct. 1983).
Al-Cu alloys with different copper contents ranging from 10 to 45 wt% were deformed in compression in the as-cast condition. Measurements of the strain-rate sensitivity parameter m using the crosshead speed jump technique show that alloys of composition close to the eutectic become superplastic after about 25% strain, with m increasing from about 0.2 at the beginning of deformation to about 0.5 or more, depending on composition. This transition to the superplastic state is accompanied by an important decrease of the flow stress during compression and it is associated by the breakdown of the initially lamellar structure of the eutectic phase in the highly deformed regions of the specimen. Moreover for the alloy with 37 wt.% copper, the transition corresponds also to the degeneration of the dendritic primary phase and this alloy shows a particularly high value of m and a low steady state flow stress in spite of the large volume fraction of the hard $CuAl_2$ compound. (18 refs.)

120375 The mechanical properties of PVC under high pressure. J.Yuan, A.Hiltner, E.Baer (Dept. of Macromolecular Sci., Case Western Reserve Univ., Cleveland, OH, USA).
J. Mater. Sci. (GB), vol.18, no.10, p.3063-71 (Oct. 1983).
The deformation properties of PVC have been studied under high pressure. Craze initiation and yield criteria have been proposed. The brittle-to-ductile transition was observed between 1×10^7 and 2×10^7 Pa, which is a relatively low transition pressure compared to polystyrene. Deformation in the post-yield region occurred by neck formation and subsequent drawing to produce chain orientation. When PVC was exposed to the pressure-transmitting fluid, silicon oil, a strong environmental stress cracking effect was observed. (38 refs.)

120376 Characterization of creep cavitation in sintered alumina by small-angle neutron scattering. R.A.Page, J.Lankford (Southwest Res. Inst., San Antonio, TX, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.146-8 (Aug. 1983).
Small-angle neutron scattering experiments were performed on compression-crept alumina. The results suggest that grain-boundary cavities on the order of 100 nm in diameter, probably are present initially. For compression strains up to 8%, the average cavity size changes very little. However, the cavity density approximately triples, and it appears that the cavities become elongated in the direction of the compression axis. (16 refs.)

120377 The mechanical properties of cellular solids. M.F.Ashby.
Metall. Trans. A (USA), vol.14A, no.9, p.1755-69 (Sept. 1983).
The mechanical properties (elastic, plastic, creep, and fracture) of cellular solids or foams are related to the properties of the cell wall material and to the cell geometry. The properties are well described by simple formulae. Such materials occur widely in nature and have many potential engineering applications. (42 refs.)

120378 Influence of nonsteady state behavior on superplastic deformation of a 25.7 Cr-6.6 Ni stainless steel. B.P.Kashyap, A.K.Mukherjee (Dept. of Mech. Engng., Univ. of California, Davis, CA, USA).
Metall. Trans. A (USA), vol.14A, no.9, p.1875-82 (Sept. 1983).
Superplastic behavior of a microduplex stainless steel (IN744) was studied by deforming specimens with initially elongated grains. As a result of deformation, grain growth and breaking up of elongated grains were noticed to occur concurrently. These microstructural instabilities result in strain hardening or strain softening, respectively. This then leads to nonuniqueness in the flow behavior. Some examples of nonuniqueness in stress-strain rate relation include the presence of: strength anisotropy, increase in strain rate sensitivity, constant stress level for varying grain size, and two distinct stress-strain rate curves over comparable test condition for the same initial microstructure. These have been explained by the concomitant microstructural changes and the influence of such changes on instantaneous flow stress. Emphasis is made on the need to eliminate microstructural instability in order to characterize the deformation phenomena under steady state. (21 refs.)

120379 Microstructure and mechanical properties of Zn-Al alloys at room temperature. J.Negrete (Inst. de Geologia y Metalurgia, Univ. Autonoma de San Luis Potosi, San Luis Potosi, Mexico), L.Valdes, G.Torres-Villasenor.
Metall. Trans. A (USA), vol.14A, no.9, p.1931-4 (Sept. 1983).
Examines some of the mechanical properties of Zn-Al alloys in the composition range 60 to 85 wt.% Zn at room temperature after ice-water quenching, air cooling, and slow cooling of the alloys. These alloys in the quenched condition show superplastic behavior at high temperatures. (6 refs.)

120380 Experimental investigation of the stability of fiberglass cylindrical shells subject to prolonged application of twisting moments. V.M.Leizerakh, S.V.Sekletov (Moscow Power Engng. Inst., Moscow, USSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.692-6 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.1029-33 (Nov.-Dec. 1982). [received: Sept. 1983]
Torsional testing was conducted of shells fabricated from a T-13 linen-interweave glass fabric. The fabric was impregnated with an EP-5122 binder, whose content was maintained in the range of 31-32%. A 300-mm-wide strip was wound under low tension on a steel mandrel heated to 120°C and coated with Teflon. The shell was placed in a thermostat on the mandrel, where it was polymerized at 120±3°C. The thermostat was then disengaged, and the shell remained in it on the mandrel. The mechanical characteristics of the finished-shell material were determined by testing circular specimens. (3 refs.)

120381 The effect of physical ageing on the properties of poly(ethylene terephthalate). A.Aref-Azar, F.Biddlestone, J.N.Hay, R.N.Haward (Dept. of Chem., Univ. of Birmingham, Birmingham, England).
Polymer (GB), vol.24, no.10, p.1245-51 (Oct. 1983).
Physical ageing rates of poly(ethylene terephthalate) have been measured, and ageing is interpreted to be associated with the conventional glass formation process, which occurs at a more rapid rate at higher temperatures. Ageing is accompanied by a marked change in mechanical properties, increased tensile yield stress and drawing stress, more localized yielding of the polymer and a marked decrease in impact strength. The fracture results have been attributed to the increased yield stress and a change in contribution of plane stress and plane strain conditions in the samples. Fracture surfaces show evidence of mixed modes of fracture. (29 refs.)

120382 Polyurethane microcellular elastomers. I. Effect of chemical composition on tensile strength and elongation at break of poly(ethylene-butylene adipate) based systems. T.Korodi, N.Marcu (Intreprinderea de Spume Poliuretanice, Timisoara, Rumania).
Polymer (GB), vol.24, no.10, p.1321-6 (Oct. 1983).
The relationships between tensile strength and elongation at break and the chemical composition of a microcellular elastomer used in shoe sole technology have been calculated using multiple linear regression analysis. Using the statistical Student's test, the importance of the factors that influence the above characteristics have been established. It has been found that the moulded density has the major influence on the tensile strength while the elongation at break depends to a great extent on the hard-segment dispersion into the soft matrix, as indicated by the influence of the water contents and the quasi-prepolymer index (I_{NCO}). Hydroxyl number in the usual range of 52-61 mg KOH/g has no influence on the above characteristics. (22 refs.)

120383 Deformation and fracture behaviour of a rubber-toughened epoxy. I. Microstructure and fracture studies. A.J.Kinloch, S.J.Shaw, D.A.Tod (Ministry of Defence, Propellants, Explosives & Rocket Motor Establ., Waltham Abbey, England), D.L.Hunston.
Polymer (GB), vol.24, no.10, p.1341-54 (Oct. 1983).
The microstructure and fracture behaviour of an unmodified and a rubber-modified epoxy have been studied. Values of the stress intensity factor, K_{Ic}, at the onset of crack growth, the type of crack growth, and the detailed nature of the associated fracture surfaces have been ascertained. Both materials exhibit essentially the same types of crack growth but the values of K_{Ic}, for the rubber-modified material were usually significantly higher than those for the unmodified epoxy. The mechanisms for this increased toughness have been considered and a mechanism that accounts for all the observed characteristics has been proposed. (47 refs.)

120384 Deformation and fracture behaviour of a rubber-toughened epoxy. II. Failure criteria. A.J.Kinloch, S.J.Shaw (Ministry of Defence, Propellants, Explosives & Rocket Motor Establ., Waltham Abbey, England), D.L.Hunston.
Polymer (GB), vol.24, no.10, p.1355-63 (Oct. 1983).
For pt.I see ibid., vol.24, no.10, p.1341-54 (1983). The microstructure and fracture characteristics of a rubber-modified epoxy, and for comparison that of the unmodified epoxy, were previously examined in detail. Based on this analysis a qualitative mechanism involving cavitation, shear yielding and plastic flow was proposed. As an extension of this work, the present paper considers the yield behaviour of the epoxy material and uses the data determined, together with the previously reported fracture results, to calculate values of the crack opening displacement. The rate/temperature dependence of the crack opening displacement and the correlations established between stress intensity factor, K_{Ic}, yield stress and type of crack growth suggest that the extent of crack tip blunting largely governs the relative toughness of the epoxy materials and induces transitions in the types of crack growth observed. A quantitative expression is then presented which successfully describes the fracture toughness values over a wide range of temperatures and rates. The two parameters in this expression are shown to be material constants and therefore provide a unique failure criterion. They can be viewed simply as curve-fitting parameters but they may also have some significance in terms of a critical stress that must act over a critical distance ahead of the crack tip to produce crack growth. (39 refs.)

120385 Theory of pseudo cross-link. III. Rheological behavior. J.Furukawa (Dept. of Appl. Chem., Aichi Inst. of Technol., Toyota, Japan).
Polym. Bull. (Germany), vol.10, no.7-8, p.336-42 (Sept. 1983).
Stress-relaxation, creep and stress-strain relations are discussed in terms of pseudo cross-link concept. The decrease of cross-links by the stress or strain leads to an equation similar to the Mooney-Rivlin equation. Viscous flow is also an important factor decreasing the cross-sectional area of the specimen and the chain-extension. Viscosity considerably decreases with an increasing rate of extension and temperature. The filler ingredient plays roles of not only enchancing the chain strain but also providing the pseudo cross-link due to adsorption of the rubber on the filler surface. (3 refs.)

120386 Resistance to deformation of pressed strips from granulated alloys. Yu.A.Gorbunov, I.G.Rusov, V.I.Krainov, V.A.Kir'yanov (Krasnoyarsk Inst. of Nonferrous Metals, Krasnoyarsk, USSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.22, no.2, p.90-4 (Feb. 1983). Translation of: *Poroshk. Metall. (USSR)*, vol.22, no.2, p.18-22 (Feb. 1983). [received: Sept. 1983]
The resistance to deformation of granulated aluminum alloys was studied by a method consisting of compressing cylindrical specimens in a hydraulic press. Specimens for testing were machined from strips produced by pressing granules in industrial presses of various capacities. Compression in the press was performed at rates of deformation of up to 1 sec^{-1}. During compression the work of deformation resulted in adiabatic heating of the specimen. Measurements, made with a caulked-in thermocouple, showed that the temperature of granulated aluminum alloys could rise during compression by up to 50°C. (4 refs.)

120387 Influence of deformation on the structure of matrix of compositional material. Yu.K.Glotova, I.I.Bugakov, I.I.Demidova, V.I.Irzhak, B.A.Rozenberg.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.9, p.1938-43 (Sept. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
For epoxide resin with introduced strained macroincorporations of various shape the influence of the state of the filler on the stress in the matrix has been studied. The stresses acting immediately during formation of compositional material are shown to affect the structure of the matrix. (3 refs.)

120388 Mechanical properties of Cr-Ni steels and alloys after testing in N_2O_4. A.N.Lapin, A.R.Zakharov, D.A.Chistyakov, V.P.Gol'tsev, S.V.Prisedskii, V.F.Korotov, E.E.Fedyushin.
Vestsi Akad. Navuk BSSR Ser. Fiz. Energ. Navuk, no.3, p.24-8 (1983). In Russian.
The effect of N_2O_4 on transitional stress-strain characteristics of high-nickel alloys and chromium-nickel steels at temperatures ranging from 120 to 650°C has been investigated. (11 refs.)

120389 Study of the effect of circumferential temperature variations on fuel-sheath strain in an inert atmosphere. J.Ferner, R.K.Rondeau, H.E.Rosinger.
Report AECL-7789, Atomic Energy Canada Ltd., Chalk River, Ont. (July 1983), 31 pp.
A failure model for Zircaloy-4 fuel sheaths has been developed and used to predict the effect of circumferential temperature variations (ΔT) on fuel-sheath strain behaviour in an inert atmosphere. In addition, experimental data were generated for fuel-sheath failures in the α- and $(\alpha+\beta)$-phase regions and compared to the predictions of the model. For both the experimental data and the model predictions it was found that increasing ΔT decreases sheath strain. Most of the reduction in burst strain with increasing ΔT occurs in the first 15K to 20K. For high ΔT values, burst strains in the α- and $(\alpha+\beta)$-

phase regions tend to an asymptotic value in the range 5 to 20%, irrespective of both heating rate and circumferential temperature variation. (16 refs.)

120390 Tensile and flexural properties of fibers of an extended chain polymer. S.R.Allen, A.G.Filippov, R.J.Farris, E.L.Thomas.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.1/1-6
The mechanical behavior of poly-(p-phenylene benzobisthiazole) fibers has been studied in tensile, bending and torsional experiments. These fibers exhibit tensile moduli of 100-300 GPa with strengths of 1-3.3 GPa depending on processing conditions and the resulting degree of molecular order. Torsional and bending experiments demonstrate the mechanical anisotropy resulting from the very high molecular orientation of the rod-like molecules along the fiber axis. X-ray diffraction studies indicate the importance of the degree of lateral molecular ordering on PBT fiber properties, particularly the tensile and shear strengths of the fibers. (7 refs.)

120391 Some microlocal effects of mechanical loading on the crystalline lamellae in bulk high density polyethylene. W.Rose, C.Meurer.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.3/1-6
Lamellar crystals in semicrystalline polymers react to mechanical loading in a characteristic manner. In high density polyethylene the modifications caused by the deformation could be made visible with a high resolution using the transmission electron microscope. Shear zones, kinks, intersections of shear zones and similar were successfully demonstrated as discrete deformation elements within the structure. Selected electronmicrographs show that the method is very well suited to describe local deformation qualitatively. (3 refs.)

120392 High-temperature thermoviscoelasticity of drawn poly(ethylene terephthalate). C.P.Buckley, D.R.Salem, M.E.Sikorski (Univ. of Manchester Inst. Sci. of Technol., Manchester, England).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.4/1-5
Thermoviscoelasticity of drawn poly(ethylene terephthalate) fibres has been studied between room temperature and the melting region. Specifically, the recovery from small strain setting in torsion was measured, for fibres with various thermal treatments. In addition to the glass transition (I), another, higher temperature, relaxation process (II) was found in heat-treated fibres, separated from I by a distinct plateau. Both the plateau height and the temperature/time position of II are sensitive to details of the thermal history. The behaviour of II is believed to reflect varying degrees of crystal constraint on the amorphous fraction. (5 refs.)

120393 SANS investigation of molecular conformation in shear bands, as related to yield mechanisms in glassy polymers. J.M.Lefebvre, B.Escaig.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.5/1-5
Small angle neutron scattering experiments on plastically deformed polystyrene (PS) and polymethylmethacrylate (PMMA) allows us to characterize chain deformation for samples having undergone various temperature and constant strain-rate compression conditions. (2 refs.)

120394 Self consistent field calculations of internal conformational states in glassy polymers. J.T.Bendler (General Electric Co., Schenectady, NY, USA).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.7/1-6
Internal conformational transitions in structural subunits of a polymer chain cause the subunit to populate states of varying sizes and shapes. The atomic rearrangements may be described in terms of a molecular strain tensor which responds to stresses when the polymer is in the glassy state. Self consistent field calculations, both empirical and quantum mechanical, are used to calculate energetic and structural changes for model compounds related to polycyclohexylmethacrylate and polycarbonate. The strength of the bulk and shear loss peaks resulting from transitions in the model compounds cyclohexyltrimethylacetate and diphenyl carbonate are estimated. (10 refs.)

120395 The influence of branch length on the deformation and microstructure of polyethylene. R.A.Bubeck, H.M.Baker (Dow Chem. Co., Midland, MI, USA).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.31/1-6
Side chain branching has a profound influence on the microstructure and properties of polyethylene (PE). For a series of linear PE copolymers environmental stress crack resistance (ESCR), melting points, creep resistance and modulus, and equilibrium spherulite size were all found to increase with increasing branch length (methyl to hexyl) at a given density and molecular weight. It is proposed that at a fixed molecular weight, branch length and concentration determine spherulite size and, consequently, boundary area, in which the dry crazing/voiding occurs during the incubation period of ESC. At a fixed density, decreased spherulite size contributes to greater boundary slip and increased creep at low stresses. (8 refs.)

120396 Internal stress and distortion in injection mouldings. K.Thomas, D.Dawson, W.J.Greenwood, J.R.White, C.S.Hindle, M.Thompson (Dept. of Metall. & Materials, Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.37/1-6
Post-moulding distortion and residual stress distributions in injection-moulded plaques of polypropylene (PP) and short glass fibre-filled polypropylene (GFPP) have been compared. GFPP mouldings showed greater distortion and contained stresses of higher magnitude. The rate of relaxation of the residual stresses was greater in PP than in GFPP. The tendency to distort was found to be influenced by the gate size. Distortion was greater in mouldings produced with the platens at different temperatures but the residual stresses were not very different. Post-moulding conditioning in a temperature gradient caused distortion to develop rapidly and significantly modified the residual stress distribution with polystyrene bars. (17 refs.)

Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers ....See Entry 116931

A study on GRP skin/foam core sandwich structures ....See Entry 118413

The investigation of the behaviour of an elastic-plastic thick-walled tube under irradiation ....See Entry 118439

Use of nonlinear models of viscoelasticity in the investigation of the effect of hydrostatic pressure on the shear creep of polymeric materials ....See Entry 118440

Compression failure of a unidirectional fibrous composite with an elastoplastic matrix ....See Entry 118441

Statistical theory of fibrous media. I. Longitudinal shear ....See Entry 118442

Characteristics of brittle fracture under general combined modes including those under bi-axial tensile loads ....See Entry 118497

Bending of an infinitely long rectangular wire in conditions of radiation-induced creep and swelling ....See Entry 119056

Deformation of α-β brass with oriented and equiaxed duplex boundaries ....See Entry 119091

On the applicability of a phenomenological relationship to creep at low stresses and intermediate temperatures ....See Entry 119092

Beryllium fracture observed by in situ high voltage electron microscopy ....See Entry 119094

Role of grain boundaries in the trapping of a magnetic flux and in the change of plasticity during a superconducting-normal transition ....See Entry 119796

Defect recovery and trapping in plastically deformed Au studied by perturbed angular correlations of ^{111}In ....See Entry 119964

Development of a new hybrid material (ARALL) for aircraft structure ....See Entry 120279

Mechanisms of densification during the hot pressing of calcium oxide and synthetic doloma ....See Entry 120286

Cold pressing of wurtzite boron nitride powders under high pressures ....See Entry 120290

Development of high performance short fibre reinforced thermoplastics ....See Entry 120306

Residual stresses in plastics sheet and injection mouldings ....See Entry 120325

Long-term ageing characteristics of Hastelloy alloy X ....See Entry 120341

Deformation and recrystallisation textures of polycrystalline nickel ....See Entry 120349

Can inherited textures in the BCC phase furnish information about the type of transformation from the FCC phase? ....See Entry 120350

The influence of thermal history on the microstructure of sulfonated polystyrene ionomers ....See Entry 120354

A TEM study of microstructural changes during retrogression and reaging in 7075 aluminum ....See Entry 120355

The properties of equimolar copolycarbonates of bisphenol A with bisphenol S and 1,4-bis(hydroxymethyl)cyclohexane ....See Entry 120357

Upper-bound analysis of hot extrusion of axisymmetric rods and tubes. II. Hot extrusion of tubes ....See Entry 120358

Electron microscopy observation and X-ray microanalysis of aged martensites in a Cu-12.9 mass% Al-2.5 mass% Mn shape memory alloy ....See Entry 120359

Anelasticity and viscoplasticity in metallic glasses ....See Entry 120362

On the stress distribution in ceramo-metallic composite beams and the occurrence of transverse cracks in the ceramic overlay ....See Entry 120397

Study of the relationship between fracture toughness (J_{IC}) and bulge ductility ....See Entry 120403

Study of the effect of heat treatment on low cycle fatigue in AISI 4340 steel by acoustic emission ....See Entry 120416

Fracture toughness and fatigue behavior of Matrix II and M-2 high speed steels ....See Entry 120420

Interlayer-strength criterion for carbon-fiber-reinforced plastics under cyclic loadings ....See Entry 120424

Effect of low-cycle loading on the mechanical characteristics and structure of unidirectional organoplastic ....See Entry 120425

Effect of dimensional factors of a disperse filler on the strength of epoxy composites ....See Entry 120426

Deformation and fracture of thermoplastics containing spherical particles: a comparison between rigid spheres and rubber particles ....See Entry 120444

Effect of length and diameter of wire on the interfacial shear stresses in wire embedded concrete specimens due to pull-out of wire ....See Entry 120448

High-temperature friction of alloys of the TiN_x-TiB_2 system ....See Entry 120449

Correlations of the dry crazing resistance of glassy polymers with other physical properties ....See Entry 120460

Craze growth kinetics and the mechanical behavior of thin polystyrene films ....See Entry 120481

Mechanical properties of molybdenum coated with titanium carbide film ....See Entry 120506

Dynamic mechanical spectroscopy of sheet molding compound as a function of offset stress ....See Entry 120517

Acoustic emission during short-term creep of fiberglass plastics ....See Entry 120554

81.40N Fatigue, embrittlement, and fracture

(inc. hardness; see also 62.20M Fatigue, brittleness, fracture and cracks)

120397 On the stress distribution in ceramo-metallic composite beams and the occurrence of transverse cracks in the ceramic overlay. J.Lenz (Inst. fur Theoretische Mech., Univ. Karlsruhe, Karlsruhe, Germany).
CFI-Ceram. Forum Int. Ber. Dtsch. Keram. Ges. (Germany), vol.60, no.7, p.237-43 (19 Sept. 1983). In German, English.
The strength properties of ceramic-coated metal parts are frequently tested in three-point bending experiments. For such bending samples the distribution of stresses is determined. Once the stresses are known, a simple criterion—transgression of the ceramic's flexural strength—may serve in estimating the external load at which transverse cracks will occur in the ceramic. It is shown that the ceramic overlay (veneer) must be as thin as possible and that the metal must have as high a modulus of elasticity as possible in order to avoid cracking. The failure loads calculated with this fracture criterion coincide well with the results of experiments conducted on dental composites. (13 refs.)

120398 Cryogenic temperature near-threshold fatigue crack growth rate data for JBK-75 stainless steel. P.K.Liaw, W.A.Logsdon, M.H.Attaar (Materials Engng. Dept., Westinghouse Res. & Dev. Center, Pittsburgh, PA, USA).

Cryogenics (GB), vol.23, no.10, p.523-6 (Oct. 1983).

An important structural component of the Westinghouse Large Coil Programme superconducting magnet is the JBK-75 (modified Ad-286) stainless steel conductor sheath. Because the presence of pre-existing cracks or flaws in the conductor sheath is a potential possibility, the structural reliability of the conductor sheath would be enhanced if a threshold level of stress intensity range (ΔK_{th}) was established below which fatigue crack growth would not occur. Consequently, near-threshold fatigue growth rate data were generated at two load ratios on JBK-75 stainless steel at room and cryogenic temperatures. No load ratio effect on near-threshold fatigue crack growth rate was observed at cryogenic temperatures. (20 refs.)

120399 Failure mechanism discrimination in carbon fibre-reinforced epoxy composites. D.Valentin, P.Bonniau, A.R.Bunsell (Ecole Nat. Superieure des Mines de Paris, Eury, France).

Composites (GB), vol.14, no.4, p.345-51 (Oct. 1983).

To examine the possibility of discriminating between the various failure mechanisms which occur in carbon fibre-reinforced epoxy composites, unidirectional and crossplied specimens have been loaded to failure at various angles with respect to the fibre direction. The mechanisms which dominate the failure of unidirectional specimens under these loading conditions are known and the results have been compared with the amplitude of the acoustic signals recorded during loading. High amplitude signals were seen to originate from cracking of the matrix parallel to the fibres, whereas low amplitude signals were recorded from fibre breaks. These results have permitted an interpretation of the failure processes occurring in crossplied specimens. (8 refs.)

120400 On the increasing fracture toughness at increasing notch length of 0/90 and 0/±45/0 graphite/epoxy laminates. P.W.M.Peters (DFVLR, Koln, Germany).

Composites (GB), vol.14, no.4, p.365-9 (Oct. 1983).

Fracture mechanics applied to conventional materials successfully considers the size of the plastic zone. However, no fracture model for composites exists which implicitly considers the damage zone size at notch tips. An approach is made to estimate the influence of the damage zone size on the notch-length dependent fracture toughness of 0/90 and 0/±45/0 graphite/epoxy laminates. (13 refs.)

120401 Impact behaviour of tungsten carbide-cobalt alloys. F.Osterstock (Equipe Materiaux-Microstructure, Lab. de Cristallographie, Chimie et Physique des Solides, ISMRA, Univ. Caen, Caen, France).

Int. J. Refract. & Hard Met. (GB), vol.2, no.3, p.116-20 (Sept. 1983).

The impact behaviour of some tungsten carbide-cobalt alloys was studied. Three experimental approaches were used: pendulum, drop weight test with bending fixture, splitting using drop weight test and specimens on flat support. In the two former cases special attention was given to the comparison with the breaking parameters from static three point bending measurements. In this respect, a factor k=Udyn/U stat was introduced and its evolution with material and experimental parameters examined. The values of k are always higher than 1 and may reach 3. This variation of k with the impact parameters puts into evidence the importance of the impacting weight and the appearance of local plasticity in the energy consumption. This latter aspect is confirmed by the splitting experiments. (25 refs.)

120402 On a search for epsilon crack tip plastic zones in the fatigue of amorphous polymers. M.T.Takemori, R.P.Kambour, D.S.Matsumoto (Corporate Res. & Dev., General Electric Co., Schenectady, NY, USA).

Polym. Commun. (GB), vol.24, no.10, p.297-9 (Oct. 1983).

Epsilon plastic zones have been found at fatigue crack tips in four of the twelve glassy polymers tested to date: BPA polycarbonate, poly(phenylsulphone), BPA polyarylate, and BPA poly(estercarbonate). These resins all have high positions in a table of glassy polymers ranked in terms of the ratio of crazing resistance to shear flow resistance. (9 refs.)

120403 Study of the relationship between fracture toughness (J_{IC}) and bulge ductility. M.R.Bayoumi, M.N.Bassim (Dept. of Mech. Engng., Univ. of Manitoba, Winnipeg, Manitoba, Canada).

Int. J. Fract. (Netherlands), vol.23, no.1, p.71-9 (Sept. 1983).

A theoretical model relating fracture toughness expressed as J_{IC} and bulge ductility $\epsilon_{f,\alpha=1,\beta=0}$ for a material exhibiting linear elastic behavior at low temperature and elastic-plastic behavior at higher temperatures is proposed. This model shows a variation of J_{IC} with $\epsilon_{f,\alpha=1,\beta=0}{}^2$ for linear elastic behavior and J_{IC} with $\epsilon_{f,\alpha=1,\beta=0}$ for elastic-plastic behavior. The model contains three constants to be determined experimentally for a given material, specimen geometry and testing conditions. A case study on 1045 steel in the temperature range −60 to 25°C confirms the validity of the model. The experimental results help in determining the size of the fracture zone ahead of the crack as well as the mechanisms for crack blunting and crack growth. (16 refs.)

120404 Molecular dynamics simulation of crack tip processes in alpha-iron and copper. B.deCelis (Dept. of Nuclear Engng., MIT, Cambridge, MA, USA), A.S.Argon, S.Yip.

J. Appl. Phys. (USA), vol.54, no.9, p.4864-78 (Sept. 1983).

The intrinsic crack tip processes of either propagation by cleavage or blunting by the nucleation of dislocations from the nonlinearly stressed region at the crack tip have been simulated by a molecular dynamics approach in alpha-iron and in copper, utilizing the Johnson and Morse potentials, respectively, and a new fixed stress boundary condition at the border between the inner discrete region and the outer anisotropic linear continuum. The simulations showed that alpha-iron is inherently brittle, and fails by cleavage along a cube plane when the stress intensity factor reaches the critical Griffith value. No dislocations are nucleated in iron and even the development of restricted crack tip twinning in special orientations does not alter this intrinsic brittleness. In copper crack tip blunting at a level somewhat less than the Griffith stress intensity factor always prevented brittle crack growth by cleavage. Thus, copper is inherently ductile. Because it permitted the unhindered development of substantial nonlinear crack tip displacements, and did not prevent dislocations from penetrating through the border between the inner nonlinear material and the outer linear continuum, the new stress boundary condition was found to be far superior to the fixed or flexible boundary conditions used at this border by previous investigators. This is reflected in the observed critical stress intensity factors for brittle cleavage that were found to be nearly equal to the expected Griffith value for the stress boundary condition while the displacement boundary conditions gave results nearly three times higher. (31 refs.)

120405 Statistical analysis of multiple fracture in 0°/90°/0° glass fibre/epoxy resin laminates. P.W.Manders, T.-W.Chou (Dept. of Mech. & Aerospace Engng., Univ. of Delaware, Newark, DE, USA), F.R.Jones, J.W.Rock.

J. Mater. Sci. (GB), vol.18, no.10, p.2876-89 (Oct. 1983).

Measurements of the distributions of crack spacings developed in the 90° ply of 0°/90°/0° glass fibre/epoxy resin laminates under tensile loading show that the ply has a variable strength. As a consequence the strain at which cracking begins is very dependent on the specimen length. The observed distributions of crack spacing are not consistent with the assumption of a uniform strength for the 90° ply. A statistical model provides a good description of the cracking behaviour particularly when the cracks are widely spaced. Magnification of the stress in the matrix between the relatively stiff glass fibres leads to debonding which is observed as a reversible 'stress-whitening'. The distributions reveal a lower probability of crack formation in the understressed region close to the existing cracks and provide estimates of the size of this region. The method of analysis can be applied to many systems which exhibit multiple fracture. (18 refs.)

120406 Compression fracture statistics of compacted cement cylinders. P.Kittl, R.Aldunate (Inst. de Investigaciones y Ensayes de Materiales, Univ. de Chile, Santiago, Chile).

J. Mater. Sci. (GB), vol.18, no.10, p.2947-50 (Oct. 1983).

A statistical analysis of the compression fracture stress of compacted cement paste cylinders was made by comparison of normal, logarithmic normal and Weibull distributions. The influence of specimen size on the fracture stress was determined and compared with predictions based on crack propagation results. The results of the analysis show that the Weibull modified statistics fit in very well with the behaviour observed. (5 refs.)

120407 Macroscopic fracture surface energy of unidirectional metal matrix composites: experiment and theory. M.Taya, A.Daimaru (Dept. of Mech. & Aerospace Engng., Univ. of Delaware, Newark, DE, USA).

J. Mater. Sci. (GB), vol.18, no.10, p.3105-16 (Oct. 1983).

A method of measuring the macroscopic fracture surface energy γ_F is studied and its verification is made compared with the theoretical prediction. Metal matrix composites used in the experiment are unidirectional graphite fibre-reinforced 6061 aluminium. A good agreement between the experimental and theoretical results is obtained. (14 refs.)

120408 A new statistical model of the hydrogen embrittlement of steel. T.H.Grundy, T.J.Davies, D.A.Ryder (Dept. of Metall., Univ. of Manchester, Manchester, England).

J. Mater. Sci. (GB), vol.18, no.10, p.3128-36 (Oct. 1983).

The hydrogen embrittlement of a hardened and tempered plain carbon, eutectoid steel of 1930 MN m^{-2} tensile strength has been studied. Plain, unnotched specimens were electrolytically charged with hydrogen and then subjected to tensile tests and delayed failure tests at constant load. The test results showed a scatter characteristic of a stochastic process and it is shown that the distribution can be described by a modified form of the Weibull probability function. Fractographic results are reported which show that fracture initiated internally at oxide inclusions and it is suggested that the embrittlement can be explained by a pressure mechanism. (8 refs.)

120409 Statistical study of thermal shock damage of a borosilicate glass. M.Ashizuka, T.E.Easler, R.C.Bradt (Dept. of Materials Sci. & Engng., Pennsylvania State Univ., University Park, PA, USA).

J. Am. Ceram. Soc. (USA), vol.66, no.8, p.542-50 (Aug. 1983).

The statistical aspects of thermal shock damage were addressed by examining the strength distributions of quenched specimens. It was observed that slow crack growth effects were minor, and that severe damage commenced near K_{Ic}. The increased range of retained strengths observed after thermal shock occurs because the low-strength portion of the distribution experiences the initial thermal shock damage. Crack arrest in the damaged specimens, examined by an energy balance, indicated that a large number of surface flaws actively extend during the initial stages of thermal shock damage. (30 refs.)

120410 Measurement of dynamic hardness by controlled sharp-projectile impact. D.B.Marshall, A.G.Evans (Dept. of Materials Sci. & Mineral Engng., Univ. of California, Berkeley, CA, USA), Z.Nisenholz.

J. Am. Ceram. Soc. (USA), vol.66, no.8, p.580-5 (Aug. 1983).

Impact of ZnS by a pyramidal projectile was used to provide a measurement of the dynamic hardness and to obtain direct comparison of the contact damage produced by static loading and impact. The dynamic hardness was evaluated from measurements of residual contact dimensions as a function of impact velocity, over the velocity range 5 to 40 $m.s^{-1}$. The value obtained (H_d=5.0 GPa) was higher than the static hardness (H_s=1.9 GPa). The higher hardness in impact causes more extensive cracking, an increase in the elastic recovery of the depth of the residual contact impression, and a smaller plastic zone surrounding the contact site. The relative extents of cracking in impact and static loading are predicted by a quasi-static indentation fracture mechanics analysis along with the appropriate values of hardness. (22 refs.)

120411 Mechanical properties of fine-grained substoichiometric titanium carbide. D.B.Miracle, H.A.Lipsitt (Air Force Wright Aeronaut. Labs., Wright-Patterson Air Force Base, OH, USA).

J. Am. Ceram. Soc. (USA), vol.66, no.8, p.592-7 (Aug. 1983).

An attempt was made to lower the ductile-to-brittle transition temperature (DBTT) of polycrystalline TiC and to prevent the premature intergranular fracture noted in stoichiometric TiC at high temperatures by producing four substoichiometric compositions chosen from the single-phase TiC phase field. Each desired composition was prepared by blending and vacuum hot-pressing the appropriate mixture of Ti powder and stoichiometric TiC powder. Each billet was characterized for density, hardness, lattice parameter, and microstructure. The actual bulk compositions were determined by averaging electron probe microanalysis data collected randomly from a polished section of each billet. Specimens cut from the billets were strength-tested in four-point bending from room temperature to 1400°C and in compression from room temperature to 1200°C. A qualitative determination of the material's ductility was obtained from a load vs. deflection plot and by optical microscopy of polished surfaces after deformation. Both the hardness and strength dropped with decreasing C/Ti atom ratios. Billets produced at the lower C/Ti atom ratios showed a significant deviation from linearity of the load/deflection curve at temperatures as low as 1200°C in bending, with little or no drop in strength, and as low as 600°C in compression. (16 refs.)

120412 Strength retention in SiC ceramics after long-term oxidation. P.F.Becher (Metals & Ceramics Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).

J. Am. Ceram. Soc. (USA), vol.66, no.8, p.120-1 (Aug. 1983).

The room-temperature flexural strengths of SiC ceramics change with increasing oxidation time at 1200°C. When certain impurities (e.g. alumina, WC, and possibly others) are present, the strength continuously decreases ≈50% after 4500 h because of subsurface pit formation. materials containing B and C or Si exhibit strength increases (≥40% after 4500 h). Surface oxide growth rates substantially decrease at times $\geq$1850 h, which corresponds to an increase in cristobalite formation. (7 refs.)

120413 Quantitative correlation of acoustic emission to the brittle fracture of porous sintered glass. R.Knehans, R.Steinbrech, W.Schaarwachter (Lehrstuhl fur Werkstoffwissenschaften A, Univ. Dortmund, Dortmund, Germany).
Mater. Sci. & Eng. (Switzerland), vol.61, no.1, p.17-22 (Oct. 1983).
Acoustic emission (AE) of a burst type was monitored during controlled slow crack growth in porous sintered glass of five different mean grain sizes (17-530 μm). The AE signals of crack progression in specimens of two geometries (three-point bending and double-torsion specimens) were measured with two different sensors and were analysed to correlate quantitatively the acoustic events to the structural parameters and crack kinetics. Independent of the crack geometry and for each sintered glass batch, the number and rate of events were proportional to the fractured area and crack velocity respectively. The total number of registered events depends on the sensitivity of the AE sensors and their location. Yet both sensors yield a linear relation between grain diameter and events per grain. The AE results suggest that fracture in fine (17 μm) grains occurs in almost one crack step whereas several partial crack steps are necessary in larger grains. This mechanistic model is confirmed using scanning electron microscopy observations of the fracture surfaces. (7 refs.)

120414 Hydrogen embrittlement of three metallic glasses. T.K.G.Namboodhiri, T.A.Ramesh, G.Singh, S.Sehgal (Dept. of Metall. Engng., Banaras Hindu Univ., Varanasi, India).
Mater. Sci. & Eng. (Switzerland), vol.61, no.1, p.23-9 (Oct. 1983).
Slow strain rate tensile tests and scanning electron fractography were used to evaluate the hydrogen embrittlement of three metallic glasses, $Ni_{40}Fe_{40}B_{20}$, $Ni_{39}Fe_{39}Mo_4Si_6B_{12}$ and $Ni_{40}Fe_6Co_{20}Cr_{12}Mo_6B_{16}$. The cathodic polarization in 0.1 N H_2SO_4 of these alloys reduced their fracture strengths and produced brittle fracture. With increasing cathodic current density the fracture stress decreased and reached a plateau value of 20%-40% of the fracture stress in air. Fractography revealed the presence of a translucent film on the ductile fracture surfaces which was probably formed by incipient melting of the shear band during the final fracture stage. A large number of microvoids of various sizes were observed on the hydrogen-embrittled fracture surfaces which may have nucleated because of hydrogen. The present results support the mechanism of ductile fracture proposed by Takayama and Maddin (1976) for metallic glasses. (20 refs.)

120415 Effects of metallurgical variables on hydrogen embrittlement in AISI type 316, 321 and 347 stainless steels. P.Rozenak, D.Eliezer (Dept. of Materials Engng., Ben Gurion Univ. of the Negev, Beer-Sheva, Israel).
Mater. Sci. & Eng. (Switzerland), vol.61, no.1, p.31-41 (Oct. 1983).
The hydrogen embrittlement of AISI type 316, 321 and 347 austenitic stainless steels was studied by charging thin tensile specimens with hydrogen through cathodic polarization. Throughout this study the authors compared solution-annealed samples of various prior austenite grain sizes with samples given the additional sensitization treatment. The results show that a finer grain size improves the resistance to hydrogen cracking regardless of the failure mode. Examination of the fracture surfaces of coarse-grained specimens tested while cathodically charged shows considerable differences between the annealed and the sensitized specimens. The sensitized specimens were predominantly intergranular, while the annealed specimens had massive regions of microvoid coalescence producing ductile rupture. AISI type 347 stainless steel is much more susceptible to hydrogen embrittlement than AISI type 321 steel is, and AISI type 316 steel is the most resistant to hydrogen embrittlement. The practical implications of the experimental conclusions are discussed. (29 refs.)

120416 Study of the effect of heat treatment on low cycle fatigue in AISI 4340 steel by acoustic emission. M.Houssny-Emam, M.N.Bassim (Dept. of Mech. Engng., Univ. of Manitoba, Winnipeg, Manitoba, Canada).
Mater. Sci. & Eng. (Switzerland), vol.61, no.1, p.79-88 (Oct. 1983).
The effect of prior heat treatment on the mechanical properties, namely the characteristics of plastic deformation crack initiation and crack propagation, in the low cycle fatigue of AISI 4340 steel was investigated. Also studied was the effect of the changes in microstructure due to heat treating on the fatigue properties using electron microscop. Simultaneously, during fatigue tests, acoustic emission was used to determine the extent of fatigue damage in this steel as well as the onset of crack initiation. The results show that, for this material, softening takes place in the first few cycles for all values of hardness. This softening is correlated to the acoustic emission activity detected as well as to the changes in hardness due to the different heat treatments. Mechanisms for explaining the effect of heat treatment on fatigue crack initiation as well as acoustic emission are discussed. (17 refs.)

120417 Fracture toughness of fibre reinforced composite materials. A.Madronero de la Cal (Dept. de Estructuras y Materiales Estructurales, INTA, Madrid, Spain).
Metal. & Electr. (Spain), vol.47, no.546, p.91-102 (June 1983). In Spanish.
Discusses the possibility of using linear analysis of fracture toughness for fibre reinforced composite materials. A calculation routine is developed in order to establish what type of composite configurations lead to structures with the necessary elastic modulus, work of fracture and critical stress concentration factor, testing three point bending beam specimens. In the event that a specimen with no null coupling coefficients must be used, the elastic modulus under tension must be measured via ultrasonic wave velocity, and, using numerical methods, the elastic bending modulus could be determined. (no refs.)

120418 Relationships between fatigue resistance and spheroidization of graphite in nodular cast iron. R.L.Colombo, L.Bonello (IVECO Labs., Torino, Italy).
Metallography (USA), vol.16, no.3, p.327-30 (Sept. 1983).
A study was carried out on the notch sensitivity of fully spheroidized and incompletely spheroidized nodular cast iron. The data spread for the incompletely spheroidized material is consistently larger than that for the completely spheroidized material. However, of more importance is that the fatigue strength reduction factor is calculated to be 1.28 for the former, compared with 1.51 for the latter. This confirms the low notch sensitivity of the vermicular graphite structures, in line with observations on flake graphite structures. Nevertheless, despite the lower notch sensitivity of the incompletely spheroidized material compared to that of the fully spheroidized material, the latter still has a significantly higher fatigue limit. (4 refs.)

120419 The nature of quasicleavage fracture in tempered 5.5Ni steel after hydrogen charging. Y.H.Kim, J.W.Morris,Jr. (Univ. of California, Berkeley, CA, USA).
Metall. Trans. A (USA), vol.14A, no.9, p.1883-8 (Sept. 1983).
Quenched and tempered 5.5Ni steel was embrittled by hydrogen charging and broken in air at room temperature. The primary fracture mode was transgranular quasicleavage. The quasicleavage facets were studied by scanning electron fractography and by transmission electron microscopy of profile fractographic specimens. The latter were prepared by plating the fracture surface with nickel and thinning so that the fracture surface was contained within the region of the specimen that was transparent to the electron beam. The fracture surface generally followed martensite lath boundaries. In addition, interlath microcracks were frequently found in the material immediately beneath the fracture surface. These results suggest that transgranular hydrogen embrittlement in this steel is primarily an interlath cracking phenomenon. Since the lath boundary planes tend to lie in {110}, the results also explain the prevalence of {110} quasicleavage in the embrittled specimens, which contrasts with the {100} cleavage found in uncharged specimens broken below the ductile-to-brittle transition temperature. (15 refs.)

120420 Fracture toughness and fatigue behavior of Matrix II and M-2 high speed steels. Bingzhe Lou (Shaanxi Mech. Engng. Inst., Xian, China), B.L.Averbach.
Metall. Trans. A (USA), vol.14A, no.9, p.1889-98 (Sept. 1983).
The effects of heat treatment and of the presence of primary carbides on the fracture toughness, K_{Ic}, and the fatigue crack growth rates, da/dN, have been studied in M-2 and Matrix II high speed steels. The Matrix II steel, which is the matrix of M-42 high speed steel, contained many fewer primary carbides than M-2, but both steels were heat treated to produce similar hardness values at the secondary hardening peaks. The variation of yield stress with tempering temperature in both steels was similar, but the fracture toughness was slightly higher for M-2 than for Matrix II at the secondary hardening peaks. Fatigue crack growth rates as a function of alternating stress intensity, ΔK, showed typical sigmoidal behavior and followed the power law in the middle-growth rate region. The crack growth rates in the near threshold region were sensitive to the yield strength and the grain sizes of the steels, but insensitive to the sizes and distribution of undissolved carbides. The crack growth rates in the power law regime were shifted to lower values for the steels with higher fracture toughness. SEM observations of the fracture and fatigue crack surfaces suggest that fracture initiates by cleavage in the vicinity of a carbide, but propagates by more ductile modes through the matrix and around the carbides. (13 refs.)

120421 The effects of heat treatment on fracture toughness and fatigue crack growth rates in 440C and BG42 steels. Bingzhe Lou (Shaanxi Mech. Engng. Inst., Xian, China), B.L.Averbach.
Metall. Trans. A (USA), vol.14A, no.9, p.1899-906 (Sept. 1983).
The fatigue crack growth rates, da/dN, and the fracture toughness, K_{Ic} have been measured in two high-carbon martensitic stainless steels, 440C and BG42. Variations in the retained austenite contents were achieved by using combinations of of austenitizing temperatures, refrigeration cycles, and tempering temperatures. In nonrefrigerated 440C tempered at 150°C, about 10 vol pct retained austenite was transformed to martensite at the fracture surfaces during K_{Ic} testing, and this strain-induced transformation contributed significantly to the fracture toughness. The strain-induced transformation was progressively less as the tempering temperature was raised to 450°C, and at the secondary hardening peak, 500°C, strain-induced transformation was not observed. In nonrefrigerated 440C austenitized at 1065°C, K_{Ic} had a peak value of 30 $MPa.m^{1/2}$ on tempering at 150°C and a minimum of 18 $MPa.m^{1/2}$ on tempering at 500°C. Refrigerated 440C retained about 5 pct austenite, and did not exhibit strain-induced transformation at the fracture surfaces for any tempering temperature. The K_{Ic} values for corresponding tempering temperatures up to the secondary peak in refrigerated steels were consistently lower than in nonrefrigerated steels. All of the BG42 specimens were refrigerated and double or quadrupole tempered in the secondary hardening region; the K_{Ic} values were 16 to 18 $MPa.m^{1/2}$ at the secondary peak. (26 refs.)

120422 Fractographic observations of cleavage initiation in the ductile-brittle transition region of a reactor-pressure-vessel steel. A.R.Rosenfield, D.K.Shetty, A.J.Skidmore (Battelle-Columbus Labs., Columbus, OH, USA).
Metall. Trans. A (USA), vol.14A, no.9, p.1934-7 (Sept. 1983).
Reports the results of a fractographic study conducted on a group of 1T fracture toughness specimens of a heavy-section A508 steel denoted TSE6 tested in the ductile-brittle transition region (22 and 82°C). The fatigue-precracked specimens were loaded at rapid rate (760 or 550 mm per second) to promote cleavage-crack growth and lower-bound toughness behavior. The objective of the fractographic examinations was to understand the observed statistical variations in cleavage initiation by (a) locating the origins of unstable cleavage fracture in the vicinity of the fatigue-precrack or ductile-rupture crack fronts, (b) identifying microstructural features associated with the triggering of cleavage, and (c) documenting characteristic fracture surface dimensions such as the extent of stable-crack growth prior to unstable cleavage (Δa) and the distance of the cleavage origin from the ductile-rupture front, x (or fatigue-crack front when $\Delta a=0$). (16 refs.)

120423 A study on statistical fatigue properties of metallic materials with particular attention to the relation between fatigue life and fatigue strength distributions. T.Sakai, A.Sakaida, K.Fujitani, T.Tanaka (Dept. of Mech. Engng., Ritsumeikan Univ., Kyoto, Japan).
Mem. Res. Inst. Sci. & Eng. Ritsumeikan Univ. (Japan), no.41, p.79-91 (1982). In Japanese.
The main purpose of this study is to clarify the relation between fatigue life and fatigue strength distributions of structural metallic materials. The major results obtained are summarized as follows: (1) If the fatigue life distribution and its stress dependency are given, the fatigue strength distribution at any fixed life can be analytically derived. In particular, if a log-normal distribution with a constant standard deviation is assumed as the life distribution and if a linear central S-N curve is provided, the fatigue strength distribution is reduced to a normal distribution. (2) The fatigue life distribution at any stress level can be also theoretically derived from the fatigue strength distribution and the stress dependency of its parameters. (3) Examining the validity of this concept by using the experimental fatigue data of low carbon steel and aluminum alloys, it is shown that the analytical representation in this paper is applicable to actual engineering metallic materials. (20 refs.)

120424 Interlayer-strength criterion for carbon-fiber-reinforced plastics under cyclic loadings. Yu.N.Rabotnov, V.P.Kogaev, A.N.Polilov, V.B.Strekalov (A.A. Blagonravov Inst. of Machine Sci., Acad. of Sci., Moscow, USSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.652-6 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.983-6 (Nov.-Dec. 1982). [received: Sept. 1983]
A strength criterion is developed for composites subject to static loads, which makes it possible to explain the relationship between interlayer shear strength and the ratio of the length l of a beam of its thickness h. Fatigue testing of specimens in interlayer shear was carried out by the method of the three-point bending of a short beam. (4 refs.)

120425 Effect of low-cycle loading on the mechanical characteristics and structure of unidirectional organoplastic. M.Ya.Mikel'son, A.Kh.Kurzemnieks (Inst. of Polymer Mech., Acad. of Sci., Riga, Latvian SSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.669-73 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.1002-7 (Nov.-Dec. 1982). [received: Sept. 1983]
Low-cycle loading was found to cause significant variations in the mechanical properties of unidirectional organoplastic—a variation in the character of the σ-ϵ relationship and corresponding variations in the elastic modulus, the area of the hysteresis loop, and the accumulation of residual strain. The magnitude of the residual strain during fatigue loading increased with increasing cyclic stress and may reach 1.5% prior to failure. The area of the hysteresis loop decreased under cyclic loading. The area of the loop increased prior to failure. The total energy dissipation increased with decreasing cyclic stress. Preliminary cyclic loading on a base $N=10^3$ cycles did not have a pronounced effect on the strength of unidirectional organoplastic. (5 refs.)

120426 Effect of dimensional factors of a disperse filler on the strength of epoxy composites. V.I.Solomatov, A.N.Bobryshev, A.P.Proshin (Penza Civil Engng. Inst., USSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.674-9 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.1008-13 (Nov.-Dec. 1982). [received: Sept. 1983]
Strength tests were conducted on EC specimens fabricated by casting ED-20 epoxy resin filled with ground quartz sand, the average particle size of which was 2.38×10^{-2} mm, under normal pressure. The specimens were held at room temperature for 24 h, and then subjected to heat treatment at 80°C for 8 h. The filler content I (the percent ratio of the mass of the filler to the mass of the resin) was varied within the range from 0 to 600%. The specimens were tested in compression, bending, and for impact cyclic strength. Specimens with dimensions of $(1\times1\times1)\times10^{-2}$ m and $(1\times1\times5)\times10^{-2}$ m were used in the compression and bending tests, respectively. The strain rate in these tests was held constant and was 4×10^{-3} m/min. In the tests for impact cyclic strength, 'mushroom'-type specimens were used. (21 refs.)

120427 Quasi-brittle fracture of specimens with a cutout in the form of a line. I.I.Bugakov.
Mech. Solids (USA), vol.17, no.6, p.163-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.6, p.177-80 (1982). [received: Oct. 1983]
An attempt is made to fill the gap in the existing studies of fracture of specimens with sharp concentrators. The object of study was provided by plane specimens of glass-like polymer with a central straight-through cutout in the form of a lune. In terms of its shape, this type of cutout is intermediate between a circular hole and a crack. Experiments yielded data on quasi-brittle fracture of specimens with a lune, as well as with a circular cutout and with an initial crack. The specimen material was provided by an epoxy polymer based on ED-20 resin (elastic modulus 3 GPa, Poisson's ratio 0.35). (10 refs.)

120428 Fatigue strength of Elit 25, a glass-fibre reinforced poly(ethylene terephthalate). M.Nowak (Inst. Materialoznawstwa i Mechaniki Technicznej, Politech. Wroclawska, Wroclaw, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.4, p.113-17 (April 1983). In Polish. [received: Oct. 1983]
The results of fatigue strength investigations of unfilled PET and PET containing 25 per cent of short cut glass fibres under the following conditions of test: 10^7 cycles, temperature—298K, frequency—15 Hz have been presented. It has been found that the fatigue limit of PET and of Elit 25 changes during the exposure time according to normal distribution. The effect of water sorption, temperature, and thermal treatment on the fatigue limit of PET and Elit 25 has been studied. It has been stated that the modified types of Elit, namely Elit 25u and Elit 30EX, exhibit more advantageous fatigue properties than Elit 25. (18 refs.)

120429 Fatigue strength of Itamid 25 (glass-fibre reinforced polyamide-6). M.Nowak (Inst. Materialoznawstwa i Mech. Tech., Politech. Wroclawska, Wroclawska, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.2, p.56-9 (Feb. 1983). In Polish. [received: Oct. 1983]
Presents the results of the time interval and its decrease during the tests carried out under long-term fatigue load conditions (10^7 cycles) as well as under natural ageing conditions either with water sorption ($\tau_w=2160$ h) or with a long time of exposure ($\tau\geq84$ months). Itamid 25 material presents the following advantages: positive effect of thermal treatment and a relatively high value of the fatigue limit, Z_{go}, in the investigated time interval and its lower decrease during the full ageing cycle than in the case of reference samples prepared from pure resin matrix. Its drawbacks are, however, a higher rate of ageing and the capillary effect. Moreover, the home-made polyamide-6 (ZA Tarnow) is a material suitable for use in the manufacture of reinforced compounds, in spite of its high water sensitivity. (30 refs.)

120430 Development of a crack growth algorithm for time-dependent analysis of steam turbine rotors. A.M.Curzon, C.H.Wells.
Report EPRI-NP-3187, Electr. Power Res. Inst., Palo Alto, CA, USA (July 1983), 46 pp.
Available from Research Report Center, Box 50490, Palo Alto, CA 94303, USA.
The authors present a data base of published and yet unpublished data on the rate of high-temperature creep crack growth in 1CrMoV steel. Development of a calculational procedure for use in predicting creep crack growth that is suitable for incorporation into SAFER or similar turbine rotor life prediction codes is described. Details are provided on the parameter C*, a time-dependent parameter that is a function of stress and strain rates near the crack tip, the temperature and loading cycling effects on crack growth rates, and the prior bulk creep rupture damage.

120431 Deformation and fracture of polydiacetylene single crystal fibres. D.N.Batchelder (Dept. of Materials, Queen Mary Coll., London, England), C.Galiotis, R.T.Read, R.J.Young.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.21-6
The structure of polydiacetylene single crystal fibres has been examined by high resolution electron microscopy. The polymer molecules are aligned parallel to the fibre axis and the crystals have a high degree of perfection. The Young's modulus and fracture strength are high and the polymer chains are found to have a stiffness similar to that of polyethylene molecules. A theory has been developed to explain the dependence of the fracture strength of the fibres upon fibre diameter as being due to surface steps. The theoretical strength of the crystals has been determined and it corresponds to fracture strains in excess of 5%. (10 refs.)

120432 Generalized fracture mechanics of ductile fracture in polycarbonate. E.H.Andrews, S.R.Barnes.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.8/1-5
Ductile crack propagation was induced in polycarbonate sheet marked with a fine printed grid. The plastic strain field thus determined was used to evaluate the generalized fracture mechanics 'loss function' and this allows the surface energy for fracture to be extracted. Although smaller than the total fracture energy, the 'surface energy' obtained for polycarbonate is very large, in contrast to results from elastomeric and soft polymers. This result is explained by the fact that the 'surface energy' in polycarbonate contains the energy for craze formation, whereas in soft polymers fracture is not preceded by crazing. (7 refs.)

120433 Molecular aspects of crack formation and healing in glassy polymers. H.H.Kausch, K.Jud.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.9/1-6
The possible role of chain entanglements in stress transfer is discussed. By the new method of crack healing chain diffusion coefficients down to 1×10^{-22} m^2/s have been determined. On the basis of these results it can be estimated that the full short time stresses are transferred in PMMA and SAN once a level of 9% of the equilibrium entanglement concentration has been attained in the interfacial region. The latter estimate is based on the so far unproven proportionality between the number of new entanglements and the diffusion distance. (14 refs.)

120434 Unified approach to crack growth in glassy polymers under any load conditions. V.I.Aleshin, E.L.Aero, M.F.Lebedeva, M.I.Bessonov.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.10/1-6
The dependence of the specific fracture work on the crack growth rate has been found for PMMA glasses by double torsion under steady-state conditions. It has been used for the analysis of the crack growth kinetics under uniaxial tension and under tensile forces applied to the crack sides. The results of calculations are in agreement with experiment. Steady-state conditions have been shown to be the most sure base of further theoretical and experimental study of crack growth. (13 refs.)

120435 Ductile fracture of polypropylene. K.Prabhat, J.A.Donovan.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.13/1-6
Polypropylene (PP) can fail by tearing instability (TIS) when the elastic contraction is greater than the plastic extension due to crack growth. TIS depends on the material properties as well as the dimensions and compliance of the system. Fracture properties of 13 mm thick PP sheet were determined at deformation rates of 10^{-4} to 10^{-2} m/min. For these rates T_m, the tearing modulus, decreased from 20 to 2. Crack growth in a compact tension specimen was always stable, while stability of crack growth in double edge notch and bend specimens depended on specimen geometry. TIS theory developed by Paris and co-workers (see ASTM STP vol.668, p.5, 1979) describes the ductile fracture behaviour of PP. (10 refs.)

120436 On the strength of vulcanized rubbers. G.J.Lake, O.H.Yeoh (Malaysian Rubber Producers' Res. Assoc., Hertford, England).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.14/1-7
The influence of crack tip radius on crack propagation in vulcanized rubbers has been studied. For very sharp cracks, tearing is found to occur on a small scale at very low energies; the 'small-scale' tearing energies show relatively little variation for rubbers that differ widely in tear strength as normally measured. Thus the latter property appears to be strongly influenced by variations in the ability of rubbers to promote tip roughening. The small-scale tear behaviour is of relevance to other fracture phenomena including cutting by sharp objects and tensile failure. (19 refs.)

120437 The application of infrared microscopy to the study of polymer fatigue. M.T.Hahn, R.W.Hertzberg, R.W.Lang, J.A.Manson, J.C.Michel, A.Ramirez, C.M.Rimnac, S.M.Webler.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.19/1-6
A model describing the frequency sensitivity of fatigue crack propagation (FCP) of polymers in terms of localized versus generalized specimen heating is examined. The magnitude of heating at the crack tip and across the unbroken ligament of the specimen is measured with an infrared microscope. The results confirm the earlier hypothesis regarding the observed frequency dependence of FCP behavior. (10 refs.)

120438 Direct measurements of craze zones at crack tips in glassy thermoplastics during fatigue crack growth. W.Doll, M.G.Schinker, L.Konczol (Fraunhofer-Inst. fur Werkstoffmech., Freiburg, Germany).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.20/1-6
For a transparent thermoplastic material loaded by cyclic fatigue the behaviour of the craze zone at the moving crack tip has been investigated by applying an special experimental set-up. It allows the simultaneous measurement of the crack speed, the instantaneous load on the specimen and the microscopic interference fringe pattern of the craze zone at any moment of the loading cycle. By this, maximum width and length of the craze zone have been measured as functions of crack speed and fatigue crack growth rate in a wide frequency range on PMMA of high molecular weight. The experimental results show that in the investigated parameter range maximum craze width 2 v and hence crack opening displacement COD increase by nearly an order of magnitude. (13 refs.)

120439 Fatigue crack propagation in amorphous polymers. P.Bouska (Res. Inst., CKD PRAHA, Prague Czechoslovakia), V.Zilvar.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.21/1-6
The dependence between the material Paris law parameter M and the fracture toughness, K_{Ic}, of some amorphous polymers at temperature around 293K was found. Fatigue tests have been further conducted on an epoxy resin over the temperature range 343 to 403K. These data have been analysed using an empirical crack growth rate approach. Associated changes in K_{Ic} with temperature have also been noted. (10 refs.)

120440 Fatigue of rubber in compression. A.Stevenson (Malaysian Rubber Producers' Res. Assoc., Hertford, England).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.22/1-6
Repeated deformation of rubber cylinders in compression causes cracks to initiate at tensile stress concentrations (i.e. bond edges). The cracks grow to remove the rubber which at maximum deformation bulges outside the original profile of the cylinder. The results are analysed in terms of fracture mechanics. The tearing energy, T is substantially independent of crack length. The relation between crack growth rate dc/dN and T appears to be a material property, independent of testpiece geometry. (9 refs.)

120441 Micromechanical failure predictions for polymer-matrix composites. D.F.Adams (Univ. of Wyoming, Laramie, WY, USA).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.23/1-6
A micromechanics analysis and associated finite element computer program have been developed, and used here to predict the inelastic stress state and crack propagation in a model composite. The model includes a single broken fiber surrounded by a sheath of matrix, this composite being subjected to an axial tensile stress. Both glass/epoxy and graphite/epoxy composites, for various fiber volume ratios are modeled. Curing residual stresses, and hygrothermal effects induced at elevated temperatures in humid environments, are included. Results demonstrate the ability to propagate a stable crack, and will be useful in correlating with experiments to study the role of the matrix in the failure process. (8 refs.)

120442 The use of fracture maps in a failure analysis of fibre composite materials. J.K.Wells, P.W.R.Beaumont (Dept. of Engng., Univ. of Cambridge, Cambridge, England).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.24/1-6
Models for the fracture of fibre-reinforced composites are presented. These enable two characteristic parameters (fibre pull-out length and fibre debond length) to be calculated and then used in models of energy absorption to predict composite toughness. The results are presented in a 'map' form which demonstrates the variation of toughness with the simultaneous change of two material parameters. A case study is presented which investigates the effect of moisture on the failure of an E-glass/epoxy composite. (6 refs.)

120443 Microstructure and fracture mechanical properties of short fiber reinforced thermoplastic PET. K.Friedrich (Inst. fur Werkstoffe, Ruhr-Univ., Bochum, Germany).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.26/1-6
Presents results of fracture mechanics tests and corresponding observations of the fracture behavior of short fiber reinforced, thermoplastic polyethylene terephthalate depending on microstructural parameters. The fracture toughness is higher for cracks perpendicular to the main fiber orientation and increases with the weight fraction of fibers. Fatigue cracks indicate the same tendency, i.e. their growth rate is low for cracks transverse to the fibers in samples with high fiber fraction. Additional influences on fracture behavior due to differences in matrix toughness and strength of the fiber/matrix interface are discussed. (4 refs.)

120444 Deformation and fracture of thermoplastics containing spherical particles: a comparison between rigid spheres and rubber particles. C.B.Bucknall (Cranfield Inst. of Technol., Bedford, England), D.P.Jones.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.27/1-6
Stress concentrations due to rubber particles and glass beads have been measured in a series of polypropylenes, by means of Eyring plots of yield stress against log (strain rate). The stress concentration factor depends principally upon the volume fraction of added particles. Other factors, including homogeneity of dispersion, particle size, and particle-matrix adhesion, have little effect upon yield stress, but do influence G_{IC}, as measured in three point bending at −70°C. (7 refs.)

120445 Crack propagation in a rubber-toughened epoxy. A.J.Kinloch, S.J.Shaw, D.L.Hunston (Min. of Defence (PE),,WalthamAbbey. PERME,England).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.29/1-6
A quantitative model is developed which describes the crack propagation behaviour of both an unmodified and a rubber-toughened epoxy over a wide range of test rates and temperatures. This model leads to a fracture criterion based upon attaining a critical stress acting over a critical distance at the crack tip. The more complex behaviour of the rubber-toughened epoxy when it is constrained as an adhesive layer, bonding steel substrates, is then described and differences between the bulk and adhesive joint specimens highlighted and discussed. (15 refs.)

120446 The impact fracture mechanics of semi-ductile polymers. F.X.de Charentenay, J.J.Robin, T.Vu-Khanh (Dept. de Genie Mecanique, (ERA 910),,Compiegne. Univ. de Technol. de Compiegne,France).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.33/1-6
Fracture mechanics has been applied to impact test of semi-ductile polymers. A new interpretation of the Charpy test is proposed for the fracture energy evaluation in the case of ductile-brittle fracture mode. Results of an instrumented impact test are also presented and discussed. (7 refs.)

120447 Crack growth behaviour in polyester moulding compounds. D.W.Lamb, F.W.Noble, A.G.Gibson (Dept. of Metall. & Materials Sci., Univ. of Liverpool, Liverpool, England).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.39/1-5
Crack propagation measurements on DMC containing 1.5, 6 and 12 mm chopped glass strands confirm that failure is preceded by damage zone formation ahead of the crack tip. Results suggest that at the two longer fibre lengths failure is best determined by a gross stress criterion, rather than stress intensity factor. (4 refs.)

Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers .... See Entry 116931

Characteristics of brittle fracture under general combined modes including those under bi-axial tensile loads .... See Entry 118497

Stress redistribution in a ruptured fiber of a viscoelastic composite .... See Entry 118516

Deformation of α-β brass with oriented and equiaxed duplex boundaries .... See Entry 119091

A fracture mechanics study of the fatigue of rubber in compression .... See Entry 119093

Beryllium fracture observed by in situ high voltage electron microscopy .... See Entry 119094

Development of a new hybrid material (ARALL) for aircraft structure .... See Entry 120279

Development of high performance short fibre reinforced thermoplastics .... See Entry 120306

The molybdenum corner of the ternary system Mo-Cr-B ...... See Entry 120310

Mechanical properties of Sn-Ag_3Sn alloys .... See Entry 120320

Microanalytical investigation of sintered SiC. II. Study of the grain boundaries of sintered SiC by high resolution Auger electron spectroscopy .... See Entry 120335

Enhanced age hardening of 7075 aluminum alloy after ultrasonic vibration .... See Entry 120342

Texture and cleavage in molybdenum .... See Entry 120346

Structure and properties of a rapidly quenched commercial Al-Mn alloy .... See Entry 120361

Dynamic bulk and shear relaxations in solid polymers: relationship to deformation behavior .... See Entry 120365

Influence of the plastic deformation conditions under pressure on the structure and properties of Mo .... See Entry 120371

A high performance wrought nickel-base superalloy EI-929 .. See Entry 120372

The mechanical properties of PVC under high pressure .... See Entry 120375

The mechanical properties of cellular solids .... See Entry 120377

The effect of physical ageing on the properties of poly(ethylene terephthalate) .... See Entry 120381

Deformation and fracture behaviour of a rubber-toughened epoxy. I. Microstructure and fracture studies .... See Entry 120383

Deformation and fracture behaviour of a rubber-toughened epoxy. II. Failure criteria .... See Entry 120384

Mechanical properties of Cr-Ni steels and alloys after testing in N_2O_4 .... See Entry 120388

Effect of length and diameter of wire on the interfacial shear stresses in wire embedded concrete specimens due to pull-out of wire .... See Entry 120448

Chemically-assisted fracture of thermoplastic PET reinforced with short E-glass fibre .... See Entry 120467

Effects of water on glass-filled methacrylate resins .... See Entry 120468

The disentanglement time of the craze fibrils in polymethylmethacrylate .... See Entry 120469

Methanol crazing of coarse shear bands in polystyrene .... See Entry 120470

A fracture mechanics approach to surface embrittlement in ductile polymers .... See Entry 120478

Crack initiation in thermooxidized surface skins of polyethylene .... See Entry 120479

Craze microstructure and micromechanics: the effects of entanglements .... See Entry 120480

Toughness in PB/PS block copolymers and blends .... See Entry 120484

Mechanical behaviour of TiC film coated on molybdenum by magnetron sputtering .... See Entry 120507

Weibull's distribution of time to stress corrosion cracking of Cu-Zn alloys .... See Entry 120515

On the temperature- and cyclic speed-dependence of the method of stress measurement using iron-foils .... See Entry 120518

Dynamic fracture toughness of structural steels by instrumented charpy test .... See Entry 120578

81.40P Friction, lubrication, and wear

(see also 62.20P Tribology)

120448 Effect of length and diameter of wire on the interfacial shear stresses in wire embedded concrete specimens due to pull-out of wire. I.A.Pathan (Mehran Univ. of Engng. & Technol., Jamshoro, Pakistan).
Mehran Univ. Res. J. Eng. & Technol. (Pakistan), vol.2, no.1, p.1-6 (Jan. 1983). [received: Sept. 1983]
The pull-out loads were determined for the single wire embedded concrete specimens. The average shear strength, shear strength of the interface and frictional shear stresses were calculated for various diameters and lengths of embedded wire using Greszczuk's theory of interfacial stresses. Results indicate that frictional shear stresses at the interface remain constant with the increase in length of the embedded wire. The shear strength of the interface and frictional shear stresses are found to increase with an increasing wire diameter. (9 refs.)

120449 High-temperature friction of alloys of the TiN_x-TiB_2 system. Yu.G.Tkachenko, S.S.Ordan'yan, D.Z.Yurchenko, V.K.Yulyugin, D.V.Chupov (Inst. of Materials Sci., Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.22, no.2, p.137-41 (Feb. 1983). Translation of: *Poroshk. Metall. (USSR),* vol.22, no.2, p.70-6 (Feb. 1983). [received: Sept. 1983]
It was established that the highest transverse rupture strength and wear resistance combined with the lowest coefficient of friction were shown by alloys of eutectic composition. In alloys of the $TiN_{0.9}$-TiB_2 system higher ductility during friction was exhibited by the boride phase, whose substructure experienced greater changes compared with the nitride phase. The greatest deformation during friction characterized the phases in the $TiN_{0.73}$-TiB_2 alloy. The strengthening and strength loss processes at temperatures of 20-400°C were determined by the strength loss processes occurring in the boride phase, and those above 400°C, by the strengthening and strength loss processes taking place in the nitride phase. (4 refs.)

120450 Friction and wear in ultra high vacuum a contribution to tribology. P.Marmy (Eidgenossisches Inst. fur Reaktorforschung, Wurenlingen, Germany).
Vak.-Tech. (Germany), vol.32, no.6, p.163-7 (Sept. 1983). In German.
The unlubricated movement of rubbing parts in an ultra high vacuum is the known source of seizing. This phenomenon has been described by a theory which predicts the onset of failure. The new concept of the 'abrasion energy'

of the oxide layer is introduced. This abrasion energy could be determined for the pair ETG 100—hard metal. The usefulness of the method is demonstrated from measurements. (2 refs.)

120451 The role of wear debris in the study of wear. A.D.Sarkar (Dept. of Mech. Engng., Univ. of Petroleum & Minerals, Dhahran, Saudi Arabia).
Wear (Switzerland), vol.90, no.1, p.39-47 (15 Sept. 1983). (First International Conference on Advances in Ferrography, Swansea, Wales, 22-24 Sept. 1982).
The danger of using the steady state wear rates of metals to compare materials is indicated; the total wear must also be considered. Particle size analysis shows that, in sliding wear, the smallest particles are the most numerous. Surface topographies of steel and aluminium alloys as produced in laboratory machines were compared with the corresponding wear debris. It is suggested that a representation atlas of wear debris would be a valuable aid to the diagnosis of the state of industrial friction couples without dismantling them. The beneficial role of ferrography in this regard is restated. (22 refs.)

120452 Wear studies through particle size distribution. I Application of the Weibull distribution to ferrography. B.J.Roylance (Dept. of Mech. Engng., Univ. Coll. of Swansea, Swansea, Wales), G.Pocock.
Wear (Switzerland), vol.90, no.1, p.113-36 (15 Sept. 1983). (First International Conference on Advances in Ferrography, Swansea, Wales, 22-24 Sept. 1982).
The use of wear particle size distributions as a means for distinguishing different modes of wear and determining its transitory behaviour is evaluated in terms of the quantitative analysis of Ferrograms by Quantimet. The Weibull distribution function is proposed and the results obtained from different wear situations are presented; they confirm that changes in the mean and the variance of the distribution provide clear indications of the type and extent of the wear as it progresses. (12 refs.)

120453 The contribution of particle analysis to the study of wear of metals. F.T.Barwell (Univ. Coll. of Swansea, Swansea, Wales).
Wear (Switzerland), vol.90, no.1, p.167-81 (15 Sept. 1983). (First International Conference on Advances in Ferrography, Swansea, Wales, 22-24 Sept. 1982).
The possibilities of particle tribology in general and ferrography in particular are discussed as means for identifying and quantifying the modes of wear as determined by environmental and operational factors. Whilst adhesion between interacting bodies occurs frequently, this cannot itself cause wear particles to be formed and the importance of fatigue in the wear process is stressed with reference to Japanese work. The delamination theory of wear is summarized and adduced to explain the formation of thin plate-like particles which are usually encountered under low wear conditions. A series of experiments wherein discs in edgewise contact were subjected to various loads and speeds produced a predominant number of rubbing wear platelets together with occasional spheres and cutting-type particles. (36 refs.)

First International Conference on Advances in Ferrography ..See Entry 116927

Erosion of polymer thin films during ion bombardment ....See Entry 120207

Roller bearing fatigue tester ....See Entry 120579

Laboratory evaluation of the on-line Ferrograph ....See Entry 120580

Continuous wear measurement by on-line ferrography ....See Entry 120581

The deleterious effect arising from preparation of ferrograms in ferrography and the consequences in subsequent analysis of wear particulates ....See Entry 120582

Wear studies through particle size distribution. II. Multiple field analysis in ferrography ....See Entry 120583

81.40R Electrical and magnetic properties (related to treatment conditions)

(see also 72.80 Conductivity of specific semiconductors and insulators, 74.70 Superconducting materials, 75.50 Studies of specific magnetic materials)

120454 Changes in local order and residual electrical resistance during heating of Ag-Al (15 wt.%). V.S.Zubchenko, P.V.Petrenko, O.O.Tatarov, O.V.Terukov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.7, p.82-4 (1983). In Ukrainian.
The Ag-15 at.% Al alloy is characterized by different types of short-range order within different temperature ranges. When the alloy is heated changes occur in the short-range order degree and type, which explains the observed non-monotonous variations of diffuse scattering intensity, ordering parameters and residual resistance of the Ag-15 % Al alloy. (8 refs.)

120455 On the high-energy product Fe-Pt permanent magnet alloys. K.Watanabe, H.Masumoto (Res. Inst. of Electric & Magnetic Alloys, Sendai, Japan).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.9, p.627-32 (Sept. 1983).
The permanent magnetic properties of Fe-34-67.5 at.%Pt alloy have been investigated. It is found that the magnetic properties of an Fe-38.5 at.%Pt alloy quenched from the disorder phase γ (*fcc*) region and subsequently aged at 773K (500°C) for 360 ks (100 h) in the ordered phase γ_1 (*fct*, $L1_0$-type) region, are $B_r=1.08$ T (10.8 kG), $H_c=340$ kA.m^{-1} (4.3 kOe) and $(BH)_{max}=159$ kJ.m^{-3} (20 MG.Oe). X-ray analysis and microstructural observations indicate that the magnetic hardening is due to the ordering stage from the γ phase to the γ_1 phase having a high crystal magnetic anisotropy. (15 refs.)

Effect of ageing heat treatment on the magnetic behaviour of a gold-iron alloy ....See Entry 119826

High coercive force 2-17-type $Sm_{1-x}Er_x(Co_{0.69}Fe_{0.22}Cu_{0.08}Zr_{0.02})_{7.22}$ magnets with a low temperature coefficient ....See Entry 119873

The influence of cold-working on magnetic properties in Ni_3Al ....See Entry 119889

Effect of electrolysis time on the magnetic properties of fine iron powders ....See Entry 120275

Conditions of formation, structure, and magnetic properties of finely divided iron produced in the presence of ED-20 epoxide oligomer and oleic acid ....See Entry 120276

Effect of porosity and phase composition on the magnetic properties of sintered structural steel ZhGr1D2.5K0.4 ....See Entry 120573

Possibilities of the nondestructive magnetic inspection of hardness of 32Kh2NVMBR high-strength steel ....See Entry 120574

81.40T Optical properties (related to treatment conditions)

(see also 78.20 Optical properties and materials)

120456 Epoxy materials with good optical properties for applications in electron optics. T.Spychaj (Inst. Technol. Chem., Politech. Szczecinska, Szczecin, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.4, p.105-8 (April 1983). In Polish. [received: Oct. 1983]
Requirements to be met by epoxy materials used in sealing elements in electron optics have been discussed. Methods for preparing colourless and transparent epoxy resins have been presented. The patent literature concerning the epoxy compositions used in electron optics has been briefly reviewed. Some commercial epoxy materials for applications in electron optics have been characterized. (28 refs.)

120457 Micro-scaled spectral-resolved cathodoluminescence of grains in barium titanate ceramics. G.Koschek, E.Kubalek (Fachgebiet Werkstoffe der Elektrotech., Univ. Duisburg, Duisburg, Germany).
Phys. Status Solidi a (Germany), vol.79, no.1, p.131-9 (Sept. 1983).
The grain cathodoluminescence (CL) properties of barium titanate ceramics, sintered at different oxygen partial pressures are systematically investigated. The spectra are found to be composed of different bands, the intensities of which depends strongly on the specimen temperature and on the oxygen partial pressure of the ambient atmosphere during the sintering process. By fitting the obtained spectra with superposed-Gaussian curves it is shown that the involved recombination processes can be satisfactorily explained within the configurational coordinate model. Furthermore it is possible to trace back the observed electronic transitions to vacancy luminescence, corroborating existing theories on band schemes, and on dependences of vacancy concentrations on oxygen partial pressure during the sintering. In this way the observed bands may be assigned to transitions in the energy gap of $BaTiO_3$. (13 refs.)

Effect of thermal stress on the homogeneity of optical glasses ....See Entry 118238

81.60 CORROSION, OXIDATION AND SURFACE TREATMENTS

120458 The water ageing of unsaturated polyester-based composites: influence of resin chemical structure. A.Apicella, C.Migliaresi, L.Nicolais (Polymer Engng. Lab., Univ. of Naples, Naples, Italy), L.Iaccarino, S.Roccotelli.
Composites (GB), vol.14, no.4, p.387-92 (Oct. 1983).
Mechanical and calorimetric analyses have been carried out on four glass fibre laminated polyester resins (isophthalic, vinyl ester and bisphenol A and B) aged in liquid water at 20°C and 90°C, and the water uptake kinetics are described. Weight losses, disc shaped crack formation, embrittlement, fibre debonding and delamination are the principal morphological changes observed. The autocatalytic hydrolysis of the ester groups may be responsible for the chemical degradation. The hydrolytic stability of the systems investigated was improved by the inclusion of fewer ester groups in the repeating units of the initial polyester prepolymer. (10 refs.)

120459 Ion beam etching of InP. II. Reactive etching with halogen-based source gases. Y.Yuba, K.Gamo, X.G.He, Y.S.Zhang, S.Namba (Faculty of Engng. Sci., Osaka Univ., Osaka, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.7, p.1211-10 (July 1983).
For pt.I see ibid., vol.22, no.7, p.1206 (1983). The reactive-ion beam etching (R-IBE) characteristics of InP with Cl_2, CCl_2F_2 and CHF_3 have been studied. Some R-IBE characteristics of GaAs have also been studied. The etching rate for each gas has been determined as a function of ion energy, current density and angle of incidence. The highest etching rate, around 2000 Å/min, is obtained in Cl_2-IBE, while the two other source gases yield an etching rate lower than that of Ar-IBE. In the case of CCl_2F_2-IBE, the addition of Ar is found to enhance the etching considerably. These IBE techniques are used to fabricate a grating structure with a period around 2500 A. (10 refs.)

120460 Correlations of the dry crazing resistance of glassy polymers with other physical properties. R.P.Kambour (Corporate Res. & Dev., General Electric Co., Schenectady, NY, USA).
Polym. Commun. (GB), vol.24, no.10, p.292-6 (Oct. 1983).
The dry crazing resistance of a large number of glassy thermoplastics has been found to correlate equally well with either of two compound functions that contain the cohesive energy density and glass temperature. One function contains, in addition, the yield stress for shear failure the other the elastic modulus. Implications for an ultimate correlation of toughness properties with molecular structure are discussed. (34 refs.)

120461 Study of cleaved, oxidized, and heat-treated CdTe surfaces. J.-P.Haring, J.G.Werther, R.H.Bube (Dept. of Materials Sci., Stanford Univ., Stanford, CA, USA), L.Gulbrandsen, W.Jansen, P.Luscher.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1469-72 (1983).
The chemical compounds present on the surface of CdTe have been investigated after different surface preparations and correlated with the properties of junctions formed by Cr on the CdTe. X-ray photoelectron spectroscopy (XPS) analysis indicates that four different surface compositions result from five different treatments. Cleaving leaves a stoichiometric surface whereas oxidation in air leads to the formation of TeO_2. Bromine-in-methanol etch leaves a Te-enriched surface and chromate etch leaves a surface containing both TeO_2 and excess Te. Hydrogen heat treatment of an etched CdTe surface restores a stoichiometric cleavedlike surface from that disrupted by the etching process. Effects on the properties of subsequently formed junctions are evidenced by a decrease in the diode saturation current from 2×10^{-5} for a bromine-etched surface to 2×10^{-8} A/cm^2 for a cleaved surface. (12 refs.)

120462 Surface topography of oxides on InP thermally grown at high temperatures. J.J.McLaren,III, A.Nelson, K.Geib, R.Gann, C.W.Wilmsen (Dept. of Electrical Engng., Colorado State Univ., Fort Collins, CO, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1486-90 (1983).
The surface topography of the thermal oxides on InP are shown to blister for growth temperatures somewhat above 600°C. It appears that the oxide softens sufficiently to allow the trapped phosphorus at the interface to expand, thus causing the surface bubbles to form. The size of the bubbles vary considerably across a wafer and they tend to increase in size with temperature. At 780°C one bubble had a radius of ≈100 μ. At $T\lesssim650$°C the elemental phosphorus at the interface is the source of the P and the underlying substrate remains smooth. Above this temperature the InP substrate provides the P as shown by the pits in the substrate. There appears to be a relationship between the surface roughening and a change in oxide layer composition. (10 refs.)

120463 A simple, inexpensive device for ion-bombardment cleaning of samples in ultrahigh vacuum. V.M.Bermudez, R.E.Thomas (Naval Res. Lab., Washington, DC, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1557-8 (1983).
An apparatus is described which can be constructed easily from readily-available components. A tungsten filament is connected across two pins of a multipin UHV instrumentation feedthrough. To a third pin is connected an anode consisting of a section of metal foil (in this case, nickel, was used for convenience) spot welded to a stiff wire. The foil is bent into the shape of a cylindrical section, with the radius of curvature roughly equal to the intended sample-to-anode distance (~4 cm). If desired, the feed-through can be mounted on a 'port aligner' flange to permit positioning control. A typical cleaning operation consists of first backfilling the chamber to about 5×10^{-5} Torr of argon and energizing the filament (~2.2 A, 6 V a.c.). With the anode biased at +500V d.c., an emission current of about 18 mA is obtained, and an average Ar^+-ion flux of about 20 $\mu A/cm^2$ is measured at the sample. (no refs.)

120464 Initial stages of oxide formation on HgCdTe exposed to activated oxygen. J.A.Silberman, D.Laser, I.Lindau, W.E.Spicer (Stanford Electronics Lab., Stanford Univ., Stanford, CA, USA), J.A.Wilson.
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1706-11 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
The changes in chemistry and electronic structure of the (110) cleavage surface of $Hg_{0.65}Cd_{0.35}Te$ and properties of the film produced are determined by monitoring with photoemission spectroscopy the growth of thin (10 Å) oxide layers on initially clean surfaces. Oxygen uptake, normally quite slow, is stimulated in this case by operating an ionization gauge in line of sight of the sample during the exposures so as to provide a stream of excited oxygen striking the surface. A complex Te oxide is formed which retains Cd but not Hg. The Cd content appears enhanced at the oxide surface. An explanation for the behavior observed is sought in terms of the species produced by the activating gauge and the chemistry of the alloy surface. (22 refs.)

120465 Passivation properties and interfacial chemistry of photochemically deposited SiO_2 on $Hg_{0.70}Cd_{0.30}Te$. B.K.Janousek, R.C.Carscallen, P.A.Bertrand (Chem. & Phys. Lab., Aerospace Corp., Los Angeles, CA, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1723-5 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
SiO_2 deposited photochemically at a substrate temperature of 100°C has been evaluated as a surface passivant on $Hg_{1-x}Cd_xTe$ ($x=0.30$). It has been determined that the electrical properties of the (Hg,Cd)Te-SiO_2 interface are dependent on the pretreatment given the semiconductor surface prior to the insulator deposition. Formation of a thin native oxide on the (Hg,Cd)Te surface during the pretreatment appears to enhance the resultant (Hg,Cd)Te-SiO_2 interface properties. A significant spread in the (Hg,Cd)Te-SiO_2 interface properties is observed, likely owing to the nature of how this native oxide forms and interactions between the native oxide and the SiH_4 in the photochemical reactor. It is shown through neutron activation analysis that the Hg employed as a photochemical sensitizer is incorporated in the SiO_2 at a concentration of 1.8 ppm. (16 refs.)

120466 Passivation patterning technique. J.A.Van Vechten (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.3A, p.923-4 (Aug. 1983).
Electron beam patterning of silicon oxide is carried out without lithographic steps by condensing a layer of oxygen molecules on a silicon wafer cooled to 55K or below and activating localized low temperature oxidation by means of an electronically positioned electron beam. (no refs.)

120467 Chemically-assisted fracture of thermoplastic PET reinforced with short E-glass fibre. C.Lhymn, J.M.Schultz (Center for Composite Materials, Univ. of Delaware, Newark, DE, USA).
J. Mater. Sci. (GB), vol.18, no.10, p.2923-38 (Oct. 1983).
The study of the stress-rupture lifetime of a PET/glass fibre system by means of fracture mechanics methods indicates the degradation of lifetime under an aggressive environment (10% HCl solution). The SEM-EDAX analysis reveals the depletion of calcium and aluminium elements from the fibre, and this is believed to be the cause of multiple fibre fractures. The fracture toughness is decreased because the role of fibre pull-out, which is the significant energy-consuming process, is negligible. A statistical analysis, from which the lifetime behaviour can be predicted, is carried out. (14 refs.)

120468 Effects of water on glass-filled methacrylate resins. K.J.Soderholm, P.D.Calvert (School of Chem. & Molecular Sci., Univ. of Sussex, Brighton, England).
J. Mater. Sci. (GB), vol.18, no.10, p.2957-62 (Oct. 1983).
Composite materials have been prepared with up to 50 vol% glass beads in two methacrylate resins: polymethyl methacrylate and 64% bisphenol A di (glycidyl methacrylate)-36% triethyleneglycoldimethacrylate. These composites were immersed in water at 60°C for up to six months and the changes in weight, elastic modulus and compressive strength were followed. In the polymethyl methacrylate composites the water uptake levels off after 5 days. The strength and modulus decrease over this period due to plasticization of the resin, but then increase again. The cross-linked methacrylate composites show the same decrease but no subsequent increase. Silane treatment of the glass beads reduces the water uptake by the resin and the decrease in modulus and strength. (7 refs.)

120469 The disentanglement time of the craze fibrils in polymethylmethacrylate. P.Trassaert, R.Schirrer (Ecole d'application des hauts polymeres, Strasbourg, France).
J. Mater. Sci. (GB), vol.18, no.10, p.3004-10 (Oct. 1983).
A breaking time has been defined for the fibrils in the craze at the tip of a steady-state moving crack. It has been shown that, for polymethylmethacrylate above the critical temperature of −20°C, the fibrils of the craze at the crack tip break due to a thermally activated process. The activation energy is equal to 23 Kcal mol^{-1}, which corresponds fairly closely to the activation energy of the β relaxation. Then, the breaking time is probably a disentanglement time rather than a breaking time of chains, and this may be used to explain the time-temperature behaviour of the macroscopic fracture toughness. (15 refs.)

120470 Methanol crazing of coarse shear bands in polystyrene. C.C.Chau, J.C.M.Li (Dept. of Mech. Engng., Univ. of Rochester, Rochester, NY, USA).
J. Mater. Sci. (GB), vol.18, no.10, p.3047-53 (Oct. 1983).
A specimen with coarse shear bands produced at stress concentrations by compression was immersed in methanol to observe craze formation. Thin crazes were initiated at shear bands and joined together while propagating to form thick crazes. Crazes were formed only on the tension side of shear bands with the craze planes perpendicular to the shear bands. When a craze propagated through a shear band, each displaced the other at intersections. Some secondary shear bands were transformed partly into crazes resulting in about a factor of ten increase in thickness. This transformation was achieved by a tensile deformation of fibrous sheets in the shear band with simultaneous production of fine fibres. (16 refs.)

120471 Corrosion of a borosilicate glass by orthophosphoric acid. H.V.Walters (Res. & Dev. Labs., Corning Glass Works, Corning, NY, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.572-4 (Aug. 1983).
A borosilicate glass was resistant to orthophosphoric acid at 95°C, whereas considerable corrosion occurred at higher temperatures. Tenacious crystal formation provided a barrier against further attack, but also produced stress resulting in spontaneous glass breakage. The acid-glass reaction is attributed to acid dehydration and consequent transformation to aggressive pyrophosphate. (7 refs.)

120472 Fluorine treatments of soda-lime silicate glass surfaces. R.K.Brow, W.C.LaCourse (New York State Coll. of Ceramics, Alfred Univ., Alfred, NY, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.123-4 (Aug. 1983).
A series of soda-lime silicate glasses was treated for varied times at different temperatures with 1,1-difluoroethane. Sodium and calcium fluorides formed on the surface of the treated glasses. Formation of NaF is proportional to the square root of time, implying a diffusion-controlled reaction. Structural relaxation decreases the rate of bloom formation at high temperatures. (8 refs.)

120473 Characterization of insoluble layers formed by NaOH attack on the surface of a ZrO_2-containing silicate glass. A.Makishima, M.Tsutsumi, T.Shimohira (Nat. Inst. for Res. in Inorganic Materials, Ibaraki, Japan), T.Nagata.
J. Am. Ceram. Soc. (USA), vol.66, no.8, p.139-40 (Aug. 1983).
The durability of an alkali-resistant glass containing ZrO_2 in NaOH solution was studied by scanning electron microscopy. Insoluble Zr-rich reaction-product layers $\approx$1 to 3 μm thick were observed on the surface of glass which had been soaked for 25 d in 2N NaOH at 95°C. In some cases the layer seems to be an adherent film, but in others it adheres loosely to the glass surface and does not seem to effectively block alkali attack. (4 refs.)

120474 A mechanism for the effect of doping on the silicon native oxide thickness. A.Wolkenberg (Inst. of Electron Technol., Warsaw, Poland).
Phys. Status Solidi a (Germany), vol.79, no.1, p.313-22 (Sept. 1983).
A theoretical basis of surface oxidation kinetics of silicon of semiconductor purity are presented for normal ambient conditions and a relation is proposed between the native oxide layer thickness and the concentration of defects in the silicon crystallographic structure. This provides the possibility for interpreting the experimental data relation between the oxide layer thickness and the impurity concentration. The experimental data are verified and composed using various measuring techniques. The discussed hypothesis of doping-introduced defects is employed to explain the kinetics of anodic polarization on silicon electrodes. (32 refs.)

120475 Enhancement of resistance of polyethylene to seawater-promoted degradation by surface modification. R.W.Baird (Dept. of Chem. Engng., MIT, Cambridge, MA, USA).
Radiat. Phys. & Chem. (GB), vol.19, no.2, p.113-20 (1982). [received: Oct. 1983]
Low-density polyethylene was subjected to several surface-modification techniques, and the effectiveness of each method in retarding seawater-promoted degradation was evaluated. Surface treatments studied included radio-frequency glow-discharge exposure in air followed by diacid or triisocyanate co-polymerization and surface irradiation with 500 keV electrons of very low penetration. Plasma and co-polymerization treatments were monitored by ESCA and ART IR spectroscopy, from which tentative conclusions were possible concerning reaction rates and probable chemical nature of the modified surface regions. Electron irradiation was monitored by gel content and cellophane dosimetry. Samples of treated polyethylene were subjected to accelerated testing by cyclic flexure in seawater and wide-angle X-ray diffraction results showed that each treatment method studied caused retardation of degradation; however, the relative effectiveness of the various techniques varied greatly. (19 refs.)

120476 Surface grinding of high-corundum and zirconium ceramic. K.Oczos (Politechn. Rzeszowska, Rzeszawska, Poland).
Szklo & Ceram. (Poland), vol.34, no.4, p.121-6 (July-Aug. 1983). In Polish.
Presents the problems of the surface grinding process of high-corundum (with 98% Al_2O_3 content) and zirconium (10% ZrO_2−70% Al_2O_3) ceramic parts with diamond grinding wheels. Special attention has been paid to the quality assurance of the ground surfaces. The influence of various factors upon the value of normal grinding force component P_y and the surface roughness R_a has been determined. The mechanism of micromorphology in the forming of a ground surface is presented. (2 refs.)

120477 Oxidation of ultrafine boron carbide, vanadium carbide, and chromium carbide powders. Yu.L.Krut-skii, G.V.Galevskii, A.A.Kornilov (Inst. of Solid State Chem. & Ore Processing, Acad. of Sci., USSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.22, no.2, p.116-18 (Feb. 1983). Translation of: *Poroshk. Metall. (USSR)*, vol.22, no.2, p.47-50 (Feb. 1983). [received: Sept. 1983]
The investigation of the oxidation of the ultrafine carbide powders was based on high-temperature X-ray phase analysis with a DRON-0.5 diffractometer fitted with a GPVT-1500 attachment (conditions of X-ray photography: filtered copper radiation, U=35 kV, I=10 μA, ω=2 deg/min, scale of photography 1 cm=1°) and thermogravimetric analysis with a Paulik, and Eardey type derivatograph (conditions of recording of derivatograms: heating rate 10 deg C/min, sample weight 50 mg). The initial oxidation temperatures of ultrafine boron carbide, vanadium carbide, and chromium carbide powders were found to be much lower than those of powders of standard particle sizes. The increased reactivity of powders of the type investigated is attributable to their small particle size and imperfect crystal structure, which are characteristic of refractory compounds produced from the gaseous phase. (10 refs.)

120478 A fracture mechanics approach to surface embrittlement in ductile polymers. L.Rolland, K.Thomson, S.Mostovoy, L.Broutman.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.11-1/-7
A fracture mechanics approach is used to establish a criterion for surface embrittlement. One of the results of the analysis shows that the crack arrest toughness is a critical parameter which must be maximized to improve resistance to surface embrittlement. Experimental studies have been performed which support the theory. (no refs.)

120479 Crack initiation in thermooxidized surface skins of polyethylene. J.-F.Jansson, B.Terselius, U.W.Gedde.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.12/1-4
At low stresses the crack arresting transformation of the original structure into a fibrillar structure is substantially delayed. This allows the crack processes in the weak, noncrystalline regions to proceed far enough for causing long term brittle like fracture. It is suggested that the cracks formed in the brittle skin, which may be caused by thermooxidation during the production of polyethylene pipes, act as stress concentrators on the microscale accelerating the long term fracture processes. (3 refs.)

120480 Craze microstructure and micromechanics: the effects of entanglements. A.M.Donald (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England), E.J.Kramer.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.15/1-6
Quantitative transmission electron microscopy is used to study the micromechanics of crazes and deformation zones (DZs) in various glassy polymers. A strong correlation is found between a predicted maximum extension ratio λ_{max} of the craze or DZ, and the experimentally determined values λ_{craze} or λ_{DZ} for all these polymers. Polymers with a short chain contour length between entanglements l_e show an increased tendency for shear, and hence DZ formation, relative to crazing. Surface drawing is shown to be the general mechanism for craze thickening. Computed surface stress profiles for crazes grown from crack tips show stress concentrations at both the craze and crack tip; the average stress increases as l_e decreases. (3 refs.)

120481 Craze growth kinetics and the mechanical behavior of thin polystyrene films. A.Moreno, A.Moet, E.Baer (Dept. of Macromolecular Sci., Case Inst. of Technol., Cleveland, OH, USA).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.16/1-6
Craze growth kinetics and tensile stress-strain behavior of thin films (2-4 μm) cast from polystyrene with monodisperse molecular weight were examined simultaneously. The high molecular weight polymer (2×10^6) exhibited unusual 'plasticity' most of which was attributed to crazing density and craze length evolution. Craze thickening is suggested to dominate higher levels of 'plastic' deformation. (8 refs.)

120482 Mechanical properties of the crazes in glassy polymers. R.Schirrer, C.Goett.
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.17/1-5
It has been shown that the single craze which appears at the crack tip in some amorphous polymers only exists above a certain critical temperature Tc. Four material properties (Young's modulus, craze stress, critical stress intensity factor and Young's modulus of the craze material) have been measured over a wide range of temperatures around Tc. The Young's modulus of the craze material shows an important drop above the critical temperature Tc, and therefore, it might be responsible for the critical temperature. (6 refs.)

120483 Small angle electron diffraction and imaging of crazes in polystyrene. H.R.Brown (Dept. of Macromolecular Sci., Case Western Reserve Univ., Cleveland, OH, USA).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.18/1-5
Small angle electron scattering (SAES) has been used to examine the sturcture of crazes in polystyrene. A direct comparison of the SAES patterns from crazes in thin films with SAXS patterns from crazes in thick films has shown that the craze structures are similar in form but the fibrils are about 3 times larger in the thin films. A refraction effect in SAES patterns has enabled a direct measurement of the refractive index of polystyrene which was used in the calculation of craze images. (13 refs.)

120484 Toughness in PB/PS block copolymers and blends. A.S.Argon, F.S.Bates, R.E.Cohen, O.S.Gebizlioglu, C.E.Schwier (Dept. of Mech. Engng. & Chem. Engng., MIT, Cambridge, MA, USA).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.28/1-9
The mechanisms of craze matter conversion was studied in a series of anionically polymerized di-block copolymers of increasing molecular weight but constant molecular weight ratio to result in only a twisted rod morphology. A direct correspondence was found between the phase morphological wave length and the scale of the craze microstructure. The main source of improved toughness was, however, the increased entanglement density or the cross-link density in both the PS and PB phases, which could be controlled also by irradiation. In PS/K-Resins blends, having particle sizes ranging from 0.1-1.0 μm but with inner microstrucural wave lengths of only 15 nm, no craze initiation was observed from particle interfaces even though such particles interacted quite effectively with growing crazes. (13 refs.)

120485 A general model for the ESC of polyethylene in weak-swelling liquids. M.E.R.Shanahan, J.Schultz (Ecole Nat. Superieure de Chimie de Mulhouse, Mulhouse, France).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.30/1-6
The environmental stress cracking of a low-density polyethylene in weak-swelling liquids has been studied using a simple tensile creep to failure test. Three basic zones of behaviour have been shown to exist, depending on the stress level, the viscosity of the liquid and the wetting propensity of the liquid for the solid. A second order effect has also been found, which correlates with the sorption of the liquid by the polymer. (11 refs.)

Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers .... See Entry 116931

Steam generator data base .... See Entry 117598

High-level waste glass field burial tests at CRNL: The effect of geochemical kinetics on the release and migration of fission products in a sandy aquifer .... See Entry 117622

Characterization of low and medium level radioactive waste forms .... See Entry 117624

Chemical cleaning process evaluation - Westinghouse steam generators .... See Entry 117637

Ultrasonic enhancement of chemical cleaning of steam generators .... See Entry 117642

PWR model steam generator corrosion studies .... See Entry 117648

Steam generator chemical cleaning: Demonstration test in a model boiler .... See Entry 117649

Evaluation and improvement of PWR secondary-system oxygen control measures .... See Entry 117651

Ion beam etching in InP. I. Ar ion beam etching and fabrication of grating for integrated optics .... See Entry 118310

Unit-cell parameters of titanium oxynitrides .... See Entry 118965

Chemical etching behaviour of ion-irradiated SiO_2 .... See Entry 119048

Effect of surface condition on oxygen self-diffusion coefficients for single-crystal Al_2O_3 .... See Entry 119262

Oxidation enhanced and concentration dependent diffusions of dopants in silicon .... See Entry 119271

(HgCd)Te-SiO_2 interface structure .... See Entry 119353

Schottky barrier height of Au/p-$In_{1-x}Ga_xAs_yP_{1-y}$ with native oxide .... See Entry 119687

Influence of hydrogen reduction on photoelectrochemical behavior of anodic oxidized n-TiO_2-layers .... See Entry 119705

Preparation and properties of high quality polyacetylene .... See Entry 120053

Solid-state quaternary phase equilibrium diagram for the Hg-Cd-Te-O system .... See Entry 120316

Dynamic bulk and shear relaxations in solid polymers: relationship to deformation behavior .... See Entry 120365

The influence of branch length on the deformation and microstructure of polyethylene .... See Entry 120395

On a search for epsilon crack tip plastic zones in the fatigue of amorphous polymers .... See Entry 120402

Strength retention in SiC ceramics after long-term oxidation .... See Entry 120412

Generalized fracture mechanics of ductile fracture in polycarbonate .... See Entry 120432

Direct measurements of craze zones at crack tips in glassy thermoplastics during fatigue crack growth .... See Entry 120438

Micrsoctructure and composition of borided refractory metals .... See Entry 120512

Chemoabrasive polishing of MCT wafers [$Hg_{1-x}Cd_xTe$] .... See Entry 120539

Revealing structure of thermally sprayed WC-Co 88/12 and NiCrBSi coatings for wear resistance .... See Entry 120543

Trials using a SiO_2 dispersion as the polishing agent for metallographic polishing .... See Entry 120544

Sensitization of polycrystalline $SrTiO_3$ photoanodes by mechanical polishing .... See Entry 120642

Surface modification of polycrystalline p-$CuInS_2$ and p-$CuInSe_2$ electrodes for improved solar cell performance .... See Entry 120745

Materials for photothermal solar energy conversion corrosion processes .... See Entry 120756

81.60B Metals and alloys

(inc. stress corrosion cracking; anticorrosion)

120486 Factors influencing the susceptibility to intergranular attack, stress corrosion cracking and de-alloying attack of aluminium brass. F.Mazza, S.Torchio (Dept. of Phys. Chem. & Electrochem., Univ. of Milan, Milan, Italy).
Corros. Sci. (GB), vol.23, no.10, p.1053-72 (1983).
The occurrence and the severity of intergranular attack (IGA), stress corrosion cracking (SCC) and de-alloying attack in Al brass alloys have been investigated in an acidic chloride-citrate solution. Tests performed on laboratory prepared alloys, in which As and P additions were made in order to cover the whole composition range admitted by various nationsal specifications, indicated that the susceptibility to the different forms of localized corrosion is mainly related to the As and P contents and it can be markedly influenced by tempering treatments and by cold-working. The optimum corrosion performances of Al brass are displayed by alloys containing As in the 0.01-0.04% range and $P\leq0.0025\%$. (27 refs.)

120487 The corrosion behaviour of AISI 304 stainless steel in 0.1 M HCl at room temperature. III. The effect of sensitization. G.Salvago, D.Sinigaglia (Dept. of Appl. Phys. Chem., Polytech. di Milano, Milano, Italy).
Corros. Sci. (GB), vol.23, no.10, p.1073-84 (1983).
For pt.II see ibid., vol.23, p.1073 (1983). Describes the results of a study concerning the influence of sensitization upon the corrosion behavior of an AISI 304 in 0.1 M HCl at room temperature. Electrochemical tests show that sensitized steel requires long periods of time in order to reach quasi-stationary conditions, and that there is no potential field that guarantees a negligible propagation of the corrosive attack. Behavior in the passive state can depend upon behavior in the active region, due to the formation of corrosion products which are capable of inhibiting the anodic process, and of preventing the formation or facilitating the local destruction of passivity films. The metallurgical heterogeneity resulting from steel sensitization promotes the formation of inhibiting products in the active region, thus preventing a state of stable passivity to exist. The improvement in resistance to localized corrosion when molybdenum is added as an alloying element is attributed, at least in part, to a reduction in the corrosion rate in the active region. (15 refs.)

120488 Corrosion behaviour of hot-pressed austenitic stainless steel in H_2SO_4 solutions at room temperature. D.Itzhak, E.Aghion (Materials Engng. Dept., Ben-Gurion Univ. of the Negev, Beer Sheva, Israel).
Corros. Sci. (GB), vol.23, no.10, p.1085-94 (1983).
The corrosion behavior of hot-pressed stainless steel (HPSS) of type 316 was investigated. Samples of HPSS with porosity of 10-30% were prepared. The influence of the porosity factor on corrosion behaviour was investigated by potentiodynamic polarization, open circuit potential identification of corrosion products by EDAX and SEM observation. It was found that porosity of the HPSS is the main factor affecting corrosion resistance. High porosity results in low corrosion resistance. The open circuit potential of the HPSS is about −200 mV (VSCE) as compared to 200 mV for the wrought 316 stainless steel. The potentiodynamic measurements indicate that cathodic concentration polarization is achieved at a relatively low current density and secondary active-passive transition is observed at a relatively high current density in HPSS as compared to wrought 316 stainless steel. (10 refs.)

120489 The pitting corrosion of copper tubes in hot water. I.Suzuki, Y.Ishikawa, Y.Hisamatsu (Dept. of Metall. & Materials Sci., Univ. of Tokyo, Tokyo, Japan).
Corros. Sci. (GB), vol.23, no.10, p.1095-106 (1983).
The electrode potential of copper tube used in hot water distribution systems in buildings rises gradually with time of exposure and then attains to a critical value of pitting potential after a long incubation period. The process of potential rise proceeds in two stages. The first stage is the formation of a cuprous oxide layer in the potential range ≤ 60 mV(SCE) and the second stage is due to the reactions of chlorite ions accumulated in the cuprous oxide layer in the potential range >60 mV(SCE). Oxyacids and oxyanions of chlorine formed in the water, to which chlorine gas or hypochlorite was added for sterilizing process, accelerate the formation of cuprous oxide layer in the first stage, and the reaction of chlorite ions increases the electrode potential of copper tube in the second stage. (7 refs.)

120490 Characteristic features of alloy polarization curves. H.W.Pickering (Dept. of Materials Sci. & Engng., Pennsylvania State Univ., University Park, PA, USA).
Corros. Sci. (GB), vol.23, no.10, p.1107-20 (1983).
The different tendencies for dissolution of the individual components of alloys produce unique polarization behavior that is not seen in pure metals. This behavior, which is just as prevalent in base metal as in noble metal alloys, is often obscured in the polarization curves by other reactions, e.g. H_2 evolution. Four distinct polarization regions are identified and characterized in terms of the tendency for selective dissolution, surface enrichment of the more noble component and the stability of a planar surface. The greater the difference in the standard reduction potentials of the metals in the alloy, ΔE°, the more pronounced are the alloy features. The alloy composition is important in determining which alloy features occur. Stress corrosion susceptibility is greatest for one type of alloy dissolution. (42 refs.)

120491 The effect of focused ultrasound on the electrochemical passivity of iron in sulfuric acid. R.C.Alkire, S.Perusich (Dept. of Chem. Engng., Univ. of Illinois, Urbana, IL, USA).
Corros. Sci. (GB), vol.23, no.10, p.1121-32 (1983).
Focused ultrasound was used to study passivity of pure iron in 2 N H_2SO_4. Ultrasonic waves were used to depassivate a passive surface film and influence the subsequent repassivation process. A curved piezo-electric transducer produced high frequency ultrasonic waves which created cavitation at the focal point. Acoustic focal intensities up to 3.4 kW cm^{-2} were generated. Low frequency ultrasound was produced with a commerical sonicator equipped with an exponential microhorn. At high focal intensities (above 1.5 kW cm^{-2}) a single (100 ms) pulse of ultrasound produced depassivation; at low intensities continuous ultrasonic exposure was required. In all cases, the induced depassivation was followed by precipitation of a metal salt film upon the metal surface before the oxide film formation. (19 refs.)

120492 Electrochemical studies of crevice corrosion rates on stainles steels. D.Tromans (Dept. of Metall. Engng., Univ. of British Columbia, Vancouver, BC, Canada), L.Frederick.
Corrosion (USA), vol.39, no.8, p.305-12 (Aug. 1983).
A crevice corrosion cell was designed to utilize electrochemical techniques for the quantitative determination of crevice corrosion rates in three commercial austenitic stainless steels, AISI 304, 316L, and UHB 904L. Studies were conducted on Teflon/metal crevices exposed to 1 M NaCl at 22 and 55 C. Crevice corrosion current, electrochemical potential, and pH could be monitored. In addition, the area and location of each crevice corrosion site was determined in order that the data could be evaluated in terms of both the crevice corrosion site was determined in order that the data could be evaluated in terms of both the crevice corrosion current density (i) and potential (E) at the local site. These data were compared with anodic polarization studies in simulated crevice solutions. The study demonstrated the superiority of 904L; the interplay of i, E, and local solution chemistry upon crevice corrosion behavior; and allowed discussion of general guidelines for industrial monitoring of crevice corrosion. (21 refs.)

120493 The effect of dissolved oxygen and NO_3^- anions on the stress corrosion cracking of type 304 stainless steel in water at 290 C. H.Hirano (Energy & Environment Lab., Central Res. Inst. of Electric Power Industry, Tokyo, Japan), N.Aoki, T.Kurosawa.
Corrosion (USA), vol.39, no.8, p.313-22 (Aug. 1983).
The effect of dissolved oxygen and NO_3^- anions on the intergranular stress corrosion cracking (IGSCC) and transgranular stress corrosion cracking (TGSCC) of type 304 stainless steel has been studied in water at 290 C by using the constant extension rate tests (CERT) method. A strain rate of 3.33×10^{-6} sec^{-1} was applied. TGSCC occurred in water containing less than 100 ppb dissolved oxygen, while IGSCC occured at concentrations greater than 1 ppm dissolved oxygen. IGSCC was accelerated by the addition of small amounts of NO_3^- anions, but TGSCC was suppressed by the presence of this anion. The analyses of oxide films by the ion microprobe mass analyzer (IMMA) and the construction of potential-pH diagrams for Cr-H_2O, Ni-H_2O, and Fe-H_2O systems at 290 C were performed to consider the effect of dissolved oxygen and NO_3^- anions on IGSCC and TGSCC. The IMMA studies revealed that the compositions of the oxide films of type 304 stainless steel and Fe-12Cr-9.3Ni steel (the presumed composition of grain boundaries in sensitized type 304 stainless steel) were Cr-enriched at 200 ppb O_2 level. At 1 ppm O_2 level, the oxide film of type 304 stainless steel was composed of Cr-enriched phase, but the Cr content in the oxide film of Fe-12Cr-9.3Ni steel was low. At 10 ppm O_2 level, the oxide film of type 304 stainless steel was composed of Fe and Cr, but the oxide film of Fe-12Cr-9.3Ni steel was mainly composed of Fe. (27 refs.)

120494 Corrosion cracking phenomena under different polarizing and microstructural conditions in a 304 stainless steel tested in low temperature acid solutions. K.Bilogan (Dept. of Metall. & Engng. Materials, Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
Corrosion (USA), vol.39, no.8, p.323-9 (Aug. 1983).
Experiments have shown that for the various microstructural conditions of 304 type stainless steels (i.e. annealed, cold worked, and dynamically recrystallized), there was no evidence of cracking in specimens tested under freely corroding conditions. At the more active potentials (i.e. -500 to -1000 mV s.c.e.), an increased susceptibility to cracking was observed, reaching a mazimum within the potential range from -500 to -800 mV s.c.e. However, the tests performed under conditions of slow dynamic straining showed that increased amounts of previous cold work have damaging effects upon the cracking susceptibility, while all refrigeration treatments have a slight beneficial effect on cracking resistance at the more active potentials. (14 refs.)

120495 Anodic polarization characteristics of sensitized 304 austenitic stainless steel in polythionic acid environment. S.Ahmed (Dept. of Metall. Engng., Univ. of Roorkee, Roorkee, India), M.L.Mehta, S.K.Saraf, I.P.Saraswat.
Corrosion (USA), vol.39, no.8, p.330-3 (Aug. 1983).
An attempt has been made to establish anodic polarization characteristics of sensitized 304 stainless steel in Samans solution, which represents the polythionic acid environment formed in equipment during shutdown in the petroleum industry, and the various constituents of Samans solution. (14 refs.)

120496 Effect of polythionic acid concentration on stress corrosion cracking of sensitized 304 austenitic stainless steel. S.Ahmad (Dept. of Metall. Engng., Univ. of Roorkee, Roorkee, India), M.L.Mehta, S.K.Saraf, I.P.Saraswat.
Corrosion (USA), vol.39, no.8, p.333-8 (Aug. 1983).
Stress corrosion tests using U-bend specimens were carried out in Samans solutions containing polythionic acid concentrations from 0.03 moles/liter to 0.38 moles/liter. Results reveal that the stress corrosion life decreases rapidly on increasing the concentration from 0.03 to 0.18 moles/liter, but a further increase up to 0.38 moles/liter had a small effect. Stress corrosion tests were also carried out in individual thionic acid solutions in order to identify the chemical species causing SCC. The chemical analysis of the test solutions both prior to and subsequent to stress corrosion tests was also carried out. Some model tests were performed in order to ascertain the role of oxygen on SCC. The study of the change in corrosion potential with respect to time during stress corrosion tests suggest a potential range from -36 to -86 mV in which cracking occurs. (13 refs.)

120497 Surface oxidation of molten soft solder: an Auger study. E.E.de Kluizenaar (Metall. Lab., N.V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1480-5 (1983).
The composition of oxide films, formed on stagnant, molten soft solder has been studied. The influence of oxidation time and of solder composition on the oxide films was measured. On clean soft solder SnPb60-40 a complex oxide film was formed, consisting of a thin outer layer of SnO_2, a layer of SnO mixed with metallic lead, and a transition layer to the underlying solder metal. The same type of oxide layer was formed on solder with copper or with nickel. On soft solder contaminated with aluminium, zinc, or phosphorus the contaminants were preferentially oxidized, resulting in an aluminium oxide film, a zinc oxide film, and a mixed phosphorus oxide-tin oxide film, respectively. (10 refs.)

120498 Mechanical scraper for preparing clean soft metal surfaces in UHV. T.G.Kinisky, J.A.Psioda (Union Carbide Corp., Central Sci. Lab., Tarrytown, NY, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1566-8 (1983). (no refs.)

120499 Pretreatment of metallic materials for the electrodeposition of functional coatings also on rarely used metals. H.Simon.
Galvanotechnik (Germany), vol.74, no.7, p.766-71 (July 1983). In German.
There are special requirements for functional coatings with regard to their adhesion wear or abrasion resistance, their ability to withstand stress corrosion cracking, mechanical flexure, etc. These properties are also determined by the nature of the pretreatment, which is therefore of special importance in functional plating. The choice of the process for pretreatment is made more difficult because of the fact that the functional coatings are often applied on unusual, alloyed or otherwise treated basis materials. In the article, suitable processes for different conditions of service on various basis materials are presented in tabular form, whilst the processes for pretreatment and their influence on the basis metal surfaces are described. Special sections also deal with the processes of stress relieving and the degassing of hydrogen embrittled components, as well as some methods of determining adhesion. (3 refs.)

120500 Electroless nickelplating of molybdenum-containing nickel steels. F.J.Gammel, H.Nagel, O.Tuscher, R.Suchentrunk.
Galvanotechnik (Germany), vol.74, no.7, p.772-3 (July 1983). In German.
Molybdenum behaves passively in solutions which are employed in the conventional pretreatment processes accumulates on the surface and is consequently coated non-adherently with nickel. This results in cracking off and the formation of blisters on subsequent stressing. By a new process for the pretreatment of surfaces, which consists essentially of a pickle for the removal of scale and a special activation operation, it is possible to coat steels also with adherent, stressable nickel coatings electrolessly. (8 refs.)

120501 Pretreatment for the electrolytic coating of super-alloys. M.Thoma.
Galvanotechnik (Germany), vol.74, no.7, p.774-81 (July 1983). In German.
Stainless austenitic steels and super-alloys can be electroplated with a satisfactory degree of adhesion with suitable pretreatment. Anodic pretreatment processes under certain conditions produce better adhesion than chemical processes. It is possible to increase the adhesion to such an extent that the tensile strength of the nickel deposit is exceeded so that the failure occurs in the nickel. If it is necessary to replace electrolytic processes by chemical methods on account of their operational disadvantages, this can be done with Nimonic 75 without loss in quality: with other basis materials in the range described, the possibility must be checked in each particular case. (7 refs.)

120502 Anodic protection of stainless steels type 304 and type 316 in sulphuric acid. T.P.Sastry, V.V.Rao (Dept. of Chem., S.V. Regional Coll. of Engng. & Technol., Surat, India).
Indian J. Technol., vol.21, no.3, p.109-14 (March 1983). [received: Oct. 1983]
The corrosion of stainless steels type 304 and type 316 in sulphuric acid of concentrations up to 15 *N* and temperatures up to 75°C can be controlled to a very large degree by application of anodic protection. Parameters necessary for such anodic protection have been evolved at different concentrations and temperatures. By making use of these parameters it is shown that the efficiency of protection is of the order of 99.9% in all the cases reported. (24 refs.)

120503 Role of misch metal in galvanizing with a Zn-5%Al alloy. S.F.Radtke, D.C.Herrschaft (Internat. Lead Zinc Res. Organization Inc., New York, NY, USA).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.253-9 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
The properties and advantages of Galfan (a Zn-5%Al-0.05% misch metal alloy) as a corrosion-resistant coating for steel sheet and wire are described. Galfan is superior, with regard to corrosion resistance and formability, to standard galvanized steel sheet and wire of equal coating thickness and has comparable properties with regard to paintability and weldability. (6 refs.)

120504 Influence of rare earths on wrinkle formation in the scale of Fe-Cr-Al alloy. Li Bei, Li Peiliang, Wang Limin (Baotou Res. Inst. of Metall., Baotou, Mongolia).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.277 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
Summary form only given, as follows. When Fe-Cr-Al alloys were oxidized in air in the temperature range 800-1300°C the thermal etching pits of the dislocation formed on the alloy surface developed into grooves as a result of the dislocation movement. This led to the formation of numerous wrinkles in the oxide scale. No wrinkles were formed in the presence of rare earths (REs) because they prevented the formation of thermal etching pits on the alloy surface. The REs also inhibited the occurrence of thermal etching at grain boundaries and in the matrix surrounding the inclusions and the carbides on the alloy surface, and hence prevented the formation of voids at the oxide-alloy interface. This behaviour may be due to the interaction of the RE atoms with crystal defects in the alloy.

120505 The application of X-ray photoelectron spectroscopy to the study of polymer-to-metal adhesion. I. Polybutadiene coated mild steel. J.F.Watts, J.E.Castle (Dept. of Metall. & Materials Technol., Univ. of Surrey, Guildford, England).
J. Mater. Sci. (GB), vol.18, no.10, p.2987-3003 (Oct. 1983).
The nature of polybutadiene to mild steel adhesion has been characterized by X-ray photoelectron spectroscopy (XPS) used in conjunction with a novel oxide stripping/argon ion bombardment technique for interface analysis. It is concluded that the interface is more correctly described as an interphase region. The failure mode of the polybutadiene/steel couple has been determined for mechanical delamination, and corrosion induced failure; both at the free corrosion potential (FCP), and when cathodically protected. Cohesive failure of the polymer occurred in the two former instances, but when cathodically protected the film is observed to separate in two stages. These results are discussed in relation to underfilm pH and the possible importance of oxide reduction to coatings delamination from cathodically protected structures. (22 refs.)

120506 Mechanical properties of molybdenum coated with titanium carbide film. T.Shikama, H.Shinno, M.Fukutomi, M.Fujitsuka, M.Okada (Nat. Res. Inst. for Metals, Ibaraki, Japan).
J. Mater. Sci. (GB), vol.18, no.10, p.3092-8 (Oct. 1983).
TiC-coated molybdenum is mechanically tensile tested. The 6-μm thick TiC-coated molybdenum has a higher 0.2% proof strength with a slight decrease in uniform and rupture elongation than the uncoated one. This strengthening effect of the TiC coating can be explained by the constrained effect of the high strength TiC film. The 1.2 μm thick TiC-coated molybdenum starts its plastic deformation at a lower stress than the uncoated one. Also, the coating makes the stress-strain curve more smooth. These effects are attributed to the surface effect, namely, that the interface between the molybdenum substrate and the strong and brittle TiC film acts as a strong dislocation source. The compressive stress in the TiC film will also help the start of plastic deformation at lower external stresses. (9 refs.)

120507 Mechanical behaviour of TiC film coated on molybdenum by magnetron sputtering. T.Shikama, H.Shinno, M.Fukutomi, M.Fujitsuka, M.Okada (Nat. Res. Inst. for Metals, Ibaraki, Japan).
J. Mater. Sci. (GB), vol.18, no.10, p.3099-104 (Oct. 1983).
The TiC film, which is coated on molybdenum by magnetron-sputtering, is analysed after the molybdenum substrate is tensile-tested to rupture at 300 to 1070K. At 300K some portion of the film exfoliated during the molybdenum substrate deformation. The degree of exfoliation is proportional to the substrate strain up to about 30% elongation, and is proportional to the square root of the film thickness. The maximum shear stress which is generated at the interface between the film and the substrate during the deformation is estimated by the measurement of the distance between cracks. From the estimated maximum shear stress, the adhesive strength of the present TiC film is evaluated to be about 400 MN m^{-2}. (4 refs.)

120508 Heat flow during the laser transformation hardening of cylindrical bodies. S.Kou, D.K.Sun (Carnegie-Mellon Univ., Pittsburgh, PA, USA).
Metall. Trans. A (USA), vol.14A, no.9, p.1859-67 (Sept. 1983).
A heat flow model as developed for the laser transformation hardening of cylindrical bodies. Three different cases of surface hardening were considered, i.e. the surface of a solid cylinder, outer surface of a hollow cylinder, and the inner surface of a hollow cylinder. The thermal responses of the workpiece in these three different cases were compared and discussed. The validity of the model was verified with experimental results obtained on 4140 steel. The effects of operating conditions on heat flow and the surface hardening of the workpiece was discussed. These operating conditions are the travel speed of the workpiece, the power unit, the width of the laser beam on the surface of the workpiece, and the cooling of the workpiece. In order to provide general heat flow information, calculated results based on dimensionless variables were presented. (11 refs.)

120509 Enhanced stress corrosion resistance from steels having a dual-phase austenite-martensite microstructure. T.V.Venkatasubramanian, T.J.Baker (Dept. of Metall. & Materials Sci., Imperial Coll. of Sci. & Technol., London, England).
Metall. Trans. A (USA), vol.14A, no.9, p.1921-8 (Sept. 1983).
A high strength steel with an austenite-martensite duplex microstructure has been produced by extruding nickel coated steel powder. The austenite is stable and is present as a continuous network surrounding a high strength martensite. The dual-phase steel exhibits superior resistance to stress corrosion cracking in 3.5 pct NaCl solution, compared with steels of similar strength having conventional microstructures. Also, the effectiveness of the austenite in improving stress corrosion cracking resistance increases as the yield strength increases. The austenite, because of its inherent toughness, reduces the effective stress intensity at the advancing crack tip, and at the same time shields the crack tip from the corrosive environment. (7 refs.)

120510 Inhibition of corrosion of nickel in different acids by organic compounds. A.Maitra, K.Bhattacharyya, G.Singh (Dept. of Chem., Univ. of Delhi, Delhi, India).
Proc. Indian Natl. Sci. Acad. Part A, vol.49, no.1, p.143-8 (1983).
The inhibition characteristics of dicyandiamide and biguanide have been studied during the acid corrosion of nickel in 'air saturated solutions' at room temperature. It has been found that the inhibition efficiencies of these compounds vary substantially depending on the nature of the acids used. Dicyandiamide acts as an inhibitor in all the three acids investigated. Biguanide, however, catalyses the dissolution of nickel in sulphuric acid but is a better inhibitor in perchloric acid. (21 refs.)

120511 Diffusion instability of the steady-state oxidation of metals. N.R.Anisimov.
Sov. Tech. Phys. Lett. (USA), vol.8, no.11, p.569-70 (Nov. 1982). Translation of: *Pis'ma v Zh. Tekh. Fiz. (USSR),* vol.8, no.21-22, p.1320-3 (Nov. 1982). [received: Sept. 1983]
The high-temperature oxidation of metals is described satisfactorily by the diffusion theory of oxidation. In steady-state oxidation, a temperature corresponding to the thermal equilibrium between the heated sample and the surrounding medium is established. The stability of this steady-state oxidation has not been studied previously. It is shown in this letter that undamped temperature oscillations may be driven by an instability of the thermal equilibrium. The instability results from the temporal delay in the thermal effect of the chemical reaction upon a change in the temperature. A sharp increase in the temperature of the oxide film due to an acceleration of the chemical reaction is accompanied by a decrease in the surface concentration of metal ions; as a result, the diffusion of these ions toward the oxide surface accelerates. The diffusion flux density initially reaches a maximum and then drops back to a value corresponding to the steady-state density profile at the higher temperature. The power evolved by the exothermic reaction will vary in the same way. Initially, therefore, this power may exceed the heat loss (even if the heat loss is greater for the steady-state ion flux density), causing a further increase in the temperature. The period of the temperature oscillation is on the order of the diffusion relaxation time of the concentration profile in the oxide film. (4 refs.)

120512 Microsctructure and composition of borided refractory metals. H.R.Vetters, P.Mayr (Stiftung Inst. fuer Haerterei-Tech., Bremen, Germany).
Scanning Electron Microsc. (USA), pt.1, p.105-11 (1983). (Scanning Electron Microscopy 1983 Conference, Dearborn, MI, USA, 17-22 April 1983).
Methods of chemical extraction and ion beam etching have made possible the investigation of shape, size and spatial arrangement of microstructural details by means of scanning electron microscopy (SEM) and transmission electron microscopy (TEM). As a result the performance of thermochemically produced boride coatings on refractory metals (niobium, molybdenum, tantalum, tungsten) used to enhance wear and corrosion protection was found to strongly depend upon the phase composition, the shape of the boundary and the thickness of the boride layer. The gradual decrease of the boron content across the boundary, carried out by electron probe microanalysis (EPMA) and electron diffraction (ED), manifested and the existence of various boride phases. SEM investigations indicated that the growth of the boride case into the base material may be influenced by epitaxial effects. Bending tests lead to the conclusion that the toughness of the boride layers dpends upon the properties of the core metal. (14 refs.)

120513 Oxidation of molten Al-Mg alloys. I.Haginoya (Tokyo Metropolitan Industrial Technol. Center, Tokyo, Japan), T.Fukusako.
Trans. Jpn. Inst. Met. (Japan), vol.24, no.9, p.613-19 (Sept. 1983).
The oxidation mechanism of molten Al-Mg alloys was studied by means of a thermal balance, X-ray diffraction and EPMA. Oxides produced in the Al-Mg (2-12%) alloys oxidized at 923K to 1173K for 10.8 ks (3 h) were MgO or/and $MgAl_2O_4$. MgO was produced in an early stage of oxidation, and its amount increased temporarily and then decreased gradually. $MgAl_2O_4$ increased gradually in amount with decreasing amount of MgO. The oxidation reactions were indicated by the equations, $Mg+1/2O_2 \rightarrow MgO$ and $MgO+2Al+3/2O_2 \rightarrow MgAl_2O_4$, which were the consecutive reaction. MgO was produced in the form of granules around pores opened to the alloy surface and was irregularly distributed near the surface of the molten alloy. $MgAl_2O_4$ crystallized into a spinel structure from amorphous oxide and formed a homogeneously mixed layer composed of the fine oxide particles and metal. (5 refs.)

120514 Cathodic protection system fights against underground cable corrosion. R.Woyciehowsky (Bell Telephone Co., Reno, NE, USA), B.McClish, A.Bennett.
Telephony (USA), vol.205, no.10, p.38, 41-2 (29 Aug. 1983).
This article, directed primarily to development of a cathodic protection system, outlines the procedures necessary to establish and maintain a campaign to offset the effects of corrosion through the use of impressed current rectifiers. First, however, it is important to realize that there are other forms of corrosion and that basic precautions need to be taken to guard against them. (no refs.)

120515 Weibull's distribution of time to stress corrosion cracking of Cu-Zn alloys. T.Yamane, K.Hirao, K.Yoshimoto (Dept. of Materials Sci. & Engng., Osaka Univ., Suita, Japan), T.Oka, Y.Takeda.
Z. Metallkd. (Germany), vol.74, no.9, p.603-6 (Sept. 1983).
Stress corrosion cracking tests were performed. The time to the initiation of cracks, the time for the propagation of cracks and the time to fracture of annealed Cu-Zn alloys have Weibull's double or more distributions and in some cases a single distribution. The cold rolled alloys have Weibull's single distribution only. (8 refs.)

120516 Studio della decarburazione e scagliatura nei forni di riscaldo per laminazione a caldo (Study of the decarbunization and scaling ocurring in reheating furnaces for hot rolling).
Report EUR 7816 IT, Comm. European Communities, Luxembourg (1983), 118 pp. In Italian. Contract 7210.EA/407.
Oxidation and decarburization experiments have been carried out using spring steel (SAE 9262), ball bearing steel (UNI 100 Cr 6) and fastener steel (C35 BKB) and gaseous mixtures that simulate the atmosphere produced by the combustion of air methane mixtures with ratios of 1:11 and 1:14. The objective was to obtain a generalized and reliable description of the phenomena in order to simulate the actual scaling and decarburization occurring in commercial reheating furnaces. Isothermal test showed that the scaling rate is controlled by the diffusion of oxidizing gases across the gaseous boundary film and by the diffusion of the Fe^{+2} ions through the wustite (FeO) layer. The rate-determining steps of the decarburization process are the chemical reaction forming CO at the steel/scale interface and carbon diffusion within the bulk of the steel. The comparison between the values of the kinetic constants measured experimentally and those calculated theoretically shows satisfactory agreement. Using the values obtained from the isothermal test the progress of the oxidation and decarburisation reactions has been predicted for a simplified time/temperature profile similar to that in reheating furnace.

Evaluation of BWR resin intrusions on stress corrosion cracking of reactor structural materials .... See Entry 117618

Optimization of metallurgical variables to improve corrosion resistance of Inconel alloy 600 .... See Entry 117619

Crevice corrosion of lattice support alloys in secondary environments of nuclear steam generators .... See Entry 117647

On the role of surface oxides in the processes of metal etching .... See Entry 119020

Investigation of copper oxide coatings for solar selective applications .... See Entry 119373

Fabrication of A15 Nb$_3$Al Josephson tunnel junction using CF$_4$ cleaning process .... See Entry 119770

Hydrogen embrittlement of three metallic glasses .... See Entry 120414

Effects of metallurgical variables on hydrogen embrittlement in AISI type 316, 321 and 347 stainless steels .... See Entry 120415

Relief etching technique for scanning and transmission electron microscopy characterization of submicron precipitates in aluminum alloys .... See Entry 120536

Magnetic structure analysis .... See Entry 120545

Light-microscopical analysis of nitrided or nitrocarburized iron and steels .... See Entry 120585

81.70 MATERIALS TESTING

(inc. sample preparation for examination, metallographic techniques, ion and electron microprobe techniques, Auger and photoelectron techniques, defectoscopy; for measurement in the mechanics of solids and rheology, see 46.30R)

120517 Dynamic mechanical spectroscopy of sheet molding compound as a function of offset stress. K.Ard, H.Kolman, K.Venkataswamy, K.Stephens, C.L.Beatty (Dept. of Materials Sci. & Engng., Univ. of Florida, Gainesville, FL, USA).
Polym. Compos. (USA), vol.4, no.3, p.183-4 (July 1983).
It has been determined that preload and cyclic amplitude have significant effect on the results of dynamic mechanical measurements of tan δ. To illustrate the effects on composities, a particular type of sheet molding compound (SMC-R50) was used in this study. In addition to the effects of preload and cycle amplitude, the effects of frequency, and creep prior to dynamic mechanical testing were also investigated. Dynamic mechanical spectroscopy of composite materials may offer a nondestructive approach to determining if reversible microscopc delamination occurs and, in addition, the extent to which delamination occurs may be quantifiable by further development of this approach. (4 refs.)

120518 On the temperature- and cyclic speed-dependence of the method of stress measurement using iron-foils. S.Kitaoka, Y.Nagase (Faculty of Engng., Nagoya Univ., Nagoya, Japan), H.Maehata, M.Seika.
Bull. JSME (Japan), vol.26, no.216, p.938-45 (June 1983).
The authors apply the method of stress measurement using iron-foils to machine elements subjected to various service loads. Effects of variable temperatures in both high and low temperature ranges and fluctuating speeds of cyclic loads at room temperature on the critical stress of slip initiation in the iron-foil owing to fatigue are examined. The applicable test temperature range of the present method at low temperatures is also investigated. Based on the test results, stress-concentration factors in notched specimens are obtained at various fluctuating temperatures. It is concluded that the present method can be adopted for the stress measurement at variable temperatures in the range from −90°C to 400°C with sufficient accuracy. (9 refs.)

120519 The influence of magnetization on eddy current inspection of ferromagnetic tubes. V.Kelha, R.Peltonen.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.76-9 (1983).
The eddy current method is commonly used for inspecting metal tubes during manufacture. Inservice inspection, however, has been limited to the testing of nonferroamagnetic tubes due to the inherent magnetic noise. In this work it has been shown that even mild steel tubes, if magnetically saturated, can be satisfactorily inspected using the eddy current method. By using a laboratory electromagnet and the magnetizing field 2.4 to 360 kA/m, various artificial defects, through holes 0.5 to 2.5 mm in diameter, a conical hole and a groove on the outer surface of the tube, were detected by an internal differential eddy current probe. The signal level and the signal-to-noise ratio increased remarkably with increasing magnetization. (6 refs.)

120520 Applications of 3-D nuclear scattering radiography in technology and medicine. G.Charpak, J.C.Duchazeaubeneix, J.C.Faivre, D.Garreta, B.Guillerminet, D.Legrand, M.Rouger, J.C.Santiard, J.Saudinos, F.Sauli (CENS, Gif-sur-Yvette, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.156-63 (1983). In French. (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
The method presented relies on nuclear interaction but one of its attractive features is to yield a true three-dimensional view of the density distribution without any relative rotation or displacement of the beam and the object. This method, nuclear scattering radiography (NSR), is based on the strong nuclear interaction: when protons in the 1 GeV energy range are scattered by matter, the large angle deflections are produced mainly by the nuclear collisions of the proton on the protons or neutrons bound in the nuclei contained in the molecules of the object; in this range of proton beam energy, the collision has nearly the character of an elastic encounter between particles of the same mass. By measuring the trajectories of the incoming and outgoing charged particles, one obtains the space coordinates of the interaction vertices whose density distribution reflects the matter distribution in the bombarded body. The trajectories are obtained from routine techniques in high energy physics: planar localization detectors, like multiwire proportional chambers, two in front of and two after the object determines the incident and scattered trajectories which are in time coincidence. A three-dimensional matrix, a volume-image, is defined. Thus, this method is deeply different to the methods of radiography by X-ray or γ absorption in which the information on the radiographed object is integrated along beam-rays (projections). (4 refs.)

120521 Application of instrumented impact testing for studying dynamic fracture behaviour of rotor steels. K.N.Murty, N.K.Rao, H.Krishnan (Metall. Dept., Bharat Heavy Electricals Ltd., Hyderabad, India).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1173-84 (1983).
The viability of the instrumented Charpy impact testing for studying dynamic fracture behaviour of rotor steels is investigated. This encompasses determination of dynamic fracture toughness (K_{Id}) and dynamic J-integral (J_{Id}), establishing correlation between oscilloscope profiles and fracture morphology of the ruptured samples and identifying fracture mechanisms involved. The predicted oscilloscope profiles for common fracture modes, their experimental counterparts, and the inferences drawn from these concerning operating fracture mechanisms are in good accord with the fractographic observations made on broken samples. It is possible that the deduced J_{Id} values correspond to a small but finite amount of crack extension instead of zero crack extension in line with the emerging trends of J_{Id} estimation. Apart from increasing with temperature, both parameters recorded a true transition around 35°C which is attributed to the combined influenced of a change in the fracture mode and relaxation of crack tip constraint. Another significant outcome of this investigation concerns about the existence of a minimum crack depth ratio for valid J_{Id} determination which, based on a detailed fractographic study, is interpreted in terms of the collective influence of crack tip plasticity and notch constraint. (20 refs.)

120522 X-ray axial tomographic system employing X-ray film for industrial applications. P.B.Pickar (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.3B, p.1503-5 (Aug. 1983).
The present system allows one to observe defects in a thin slice of the object being studied without any interference from adjacent layers; in fact tomographs of adjacent layers can be added together to give the sum of the whole object. (no refs.)

120523 Isotope method detecting the hydride phase in palladium saturated with hydrogen. V.A.Gol'tsov, B.A.Lovanov (Donetsk Polytech. Inst., Donetsk, USSR).
Ind. Lab. (USA), vol.48, no.12, p.1198-201 (Dec. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.12, p.43-5 (Dec. 1982). [received: Sept. 1983]
The method of autoradiography was used for detecting the hydride phase in palladium. A diaphragm specimen of palladium was preactivated with tritium by saturation to contents not exceeding its content in the α solid solution. Subsequently, the diaphragm specimen was saturated with hydrogen in such a manner as to ensure that the formation of the hydride phase was accompanied by the appropriate redistribution of tritium atoms and the hydride precipitates were marked by these atoms. Since the introduction of hydrogen isotopes at room temperature by diffusion through one side of the diaphragm results in the accumulation of hydrogen in the near-surface layer on the other side of the diaphragm, the autoradiographic examination of the external surface of the specimen will yield the pattern of distribution of the hydride phase in the specimens. It should be mentioned that to prevent the breakdown of the β phase, the specimens must be shielded by hydrogen during exposure of the emulsion. (13 refs.)

120524 Investigation of the surface finish of aluminium metallization by the photometry method of dissipated radiation. B.M.Voronov, M.S.Finarev.
Ind. Lab. (USA), vol.48, no.12, p.1201-4 (Dec. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.12, p.45-7 (Dec. 1982). [received: Sept. 1983]
The method was used to investigation 0.5 μm thick aluminium films on oxidised silicon plates formed by evaporation of aluminium pieces with a tungsten resistance evaporator. (9 refs.)

120525 Planning and statistical processing of the results of tests for plotting quantile fatigue curves. M.N.Stepnov, L.V.Agamirov (Tsiolkovskii Aeronautical Engng. Inst., Moscow, USSR).
Ind. Lab. (USA), vol.48, no.12, p.1212-16 (Dec. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.12, p.52-5 (Dec. 1982). [received: Sept. 1983]
Establishes confidence limits for the quantile values of the fatigue strengths in connection with plotting fatigue curves, and also develops a procedure for the planning of fatigue tests. A normal distribution function is adopted as the hypothetical distribution of the logarithm of the fatigue life and the fatigue strength. (8 refs.)

120526 Method of investigating the rules of deformation and failure under conditions of low-cycle nonisothermal loading. A.I.Bashunin, P.I.Kotov (Moscow Inst. of Marine Transport Engng., Moscow, USSR).
Ind. Lab. (USA), vol.48, no.12, p.1216-19 (Dec. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.12, p.55-7 (Dec. 1982). [received: Sept. 1983]
Proposes a method of low cycle fatigue testing under conditions of a variable temperature without holds which has been tested on a type UME- 10TM standard production machine. The method makes it possible to investigate the resistance to deformation and failure of materials with recording of the elastoplastic hysteresis curves to stress vs mechanical strain coordinates with combinations of different methods of thermomechanical loading. (6 refs.)

120527 Determination of the ductile-brittle transition temperature of steels for the elements of fastening parts of power equipment. V.V.Anikovskii, Yu.I.Zvezdin, V.A.Ignatov, V.I.Smirnov, B.T.Timofeev.
Ind. Lab. (USA), vol.48, no.12, p.1219-25 (Dec. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.12, p.58-62 (Dec. 1982). [received: Sept. 1983]
The curve of the analysis of the condition for power equipment bolts was constructed and experimentally checked, making it possible, despite some conditionality, to establish the level of the work for failure of standard impact samples on the basis of which it is desirable to designate the value of the ductile-brittle transformation temperature of bolt steels. It is concluded that determining the parameters of fracture toughness it is important to take into consideration the specific features of a large bolt. In particular, it is necessary to test cylindrical samples with an edge segment-shaped crack, which makes it possible to obtain an approximate determination of t_{cr}. The most justified method of determining the t_{cr} of a bolt is to use not the temperature t_n obtained from an analysis of the dimorphism of failure but the ductile-brittle transformation temperature obtained by recording the moment of start of a crack, which provides independence of the parameter t_{cr} in a broad range of change in sample dimensions, since K_i does not depend upon the scale factor. (14 refs.)

120528 Device for tensile testing of brittle materials. A.K.Khersonskii, V.T.Kononenko (Sci. Production Group for Mechanization & Automation of Cotton Industry Equipment, Tachkent, USSR).
Ind. Lab. (USA), vol.48, no.12, p.1225-7 (Dec. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.12, p.62-3 (Dec. 1982). [received: Sept. 1983]
A small (100×210×191 mm) device is described for determining the ultimate strength of brittle metallic materials under uniaxial tensile load. The design features of this device ensure high measurement accuracy due to constantly uniaxial loading and strain vectors, the absence of stress concentration at the specimen ends and points of its gripping, as well as the possibility of strain rate control and of constant fixing of both specimen end during the test. (6 refs.)

120529 Heating unit for high-temperature mechanical tests. L.G.Puzrin, E.I.Peshcherin, V.M.Makedonskii, V.M.Kravchenko, V.A.Zdanevich (E.O. Paton Electric Welding Inst., Acad. of Sci., Ukrainian SSR).
Ind. Lab. (USA), vol.48, no.12, p.1227-8 (Dec. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.12, p.64-5 (Dec. 1982). [received: Sept. 1983]
A heating unit has been developed for a temperature range of up to 1200°C. The unit is free of the shortcomings of tube-type ceramic furnaces. The main part of the unit is a heater which is a Nichrome tube mounted inside a container with insulating material, which enables the heat losses to be kept at minimum and produces the required temperature difference between the heater and the external container wall. (4 refs.)

120530 Residual stress measurements by means of neutron diffraction. L.Pintschovius, V.Jung (Kernforschungszentrum Karlsruhe, Inst. fur Angewandte Kernphys., Karlsruhe, Germany), E.Macherauch, O.Vohringer.
Mater. Sci. & Eng. (Switzerland), vol.61, no.1, p.43-50 (Oct. 1983).
A new method for the analysis of multiaxial residual stress states is presented, which is based on high resolution neutron diffraction. It is analogous to X-ray stress analysis, but the use of neutrons instead of X-rays allows the analysis of the stress distributions also in the interior of technical components in a nondestructive way. To prove the feasibility of the method, investigations of

the loading stress distributions of an aluminium bar subjected to purely elastic bending were performed. Limiting factors due to the volume of the internal probe region and the sample thickness are discussed. Complete neutron residual stress analyses were carried out for a plastically deformed bending bar and a transformation-free water-quenched steel cylinder. The results are in fairly good agreement with theoretical expectations and with X-ray control measurements at the surface of the objects. (11 refs.)

120531 Evaluation of the results of automatic ultrasonic tests and grading of heavy sheet with regard to specification using an EDV-system. G.Hullin, O.A.Barbian, G.Haralamb, E.Raeder.
Mater. Test. (Germany), vol.25, no.9, p.302-6 (Sept. 1983). In German.
The pulse-echo method was used to find the depth and extent of internal flaws which were parallel to the surface of the sheet. For tests to be made on the production line, tying of the detector which scanned the echoes to a computer made possible automatic evaluation and storing of the test data. The final presentation of the data allows the determination of the linear and two-dimensional extent of the flaws. It has been possible to combine 252 test tracks. Three microprocessors have been used for the evaluation of the scanning results. (13 refs.) *R.S.*

120532 Investigations on the application of pulsed eddy current method in nondestructive testing using controlled signals. H.A.Crostack, J.Nehring.
Mater. Test. (Germany), vol.25, no.9, p.306-10 (Sept. 1983). In German.
Eddy current testing is useful for thin-walled electrically conducting test pieces because the probes do not have to touch the test piece. Working with controlled signals allows of a better discrimination between flaw indications and rogue signals. The finding of flaws depends on their depth in the test piece and on their length. Artificial flaws in austenitic and aluminium test pieces were used for the evaluation of the method. (10 refs.) *R.S.*

120533 Studies on defect indication in ultrasonic testing by the rear wall echo method. J.Muller-Hillebrand, R.Harlfinger.
Mater. Test. (Germany), vol.25, no.9, p.311-14 (Sept. 1983). In German.
Steel balls of various sizes in water put on an aluminium plate were used to simulate defects. A linear characteristic of the rear wall echo as a function of the defect diameter was obtained. This line does not go through the origin. The spread of the ultrasonic beam affects the sensitivity of the method. This can be improved by glancing incidence of the beam. (2 refs.) *R.S.*

120534 Resolution in depth of ultrasonic testers. A.Wiese, U.Opara.
Mater. Test. (Germany), vol.25, no.9, p.315-17 (Sept. 1983). In German.
Experiments were made with an ultrasonics probe and a reflector at various distances in a water bath. The electrical circuit containing a damping resistance and a series of capacitances allowed the suppression of a large part of the low frequency components. A parallel capacitance and the internal resistance limited the high frequencies. The difference between the echo from the emitter and the echo from a flaw could be increased to about 30 dB. (2 refs.) *R.S.*

120535 Some stereological properties of hexagonal prisms. J.W.Lee, J.D.Browne, D.Jaffrey (Dept. of Metall., Univ. of Newcastle, Newcastle, NSW, Australia).
Metallography (USA), vol.16, no.3, p.255-64 (Sept. 1983).
A method is described by which the ratio of base to height in crystals of trigonal symmetry may be determined from metallographic sections of the crystals in a matrix. The method is applied to a WS-25 wt.% Co sample, liquid-phase sintered at 1400°C for 100 hr, during which the WC crystals form triangular prisms. It is shown that the prisms have a base to height ratio of 2.0 ± 0.1 and are slightly truncated along the edges parallel to the prism axis. (12 refs.)

120536 Relief etching technique for scanning and transmission electron microscopy characterization of submicron precipitates in aluminum alloys. J.Howe (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Metallography (USA), vol.16, no.3, p.275-86 (Sept. 1983).
The size, type, and distribution of insoluble dispersoids and age-hardening precipitates influence the processing and final properties of aluminum alloys, and accurate characterization of these submicron precipitates is often required. A modified version of a relief etching technique introduced by Ryvola and Morris now allows rapid determination of their size, shape, and distribution in the scanning electron microscope in addition to facilitating accurate chemical and microstructural analyses by transmission electron microscope/STEM analytic and diffraction techniques. The etching procedure is applicable to almost all second phases commonly found in aluminum alloys and is simple to use. (2 refs.)

120537 Metallographic techniques for the study of continuously cast microalloyed steels. G.Ocampo, T.Castillo, V.S.Raghunathan, J.D.Embury (Dept. of Metall. & Materials Sci., McMaster Univ., Hamilton, Ontario, Canada).
Metallography (USA), vol.16, no.3, p.287-97 (Sept. 1983).
Methods are described to investigate the evolution of the final structure from the as-cast structure in HSLA steels. By using a combination of metallographic techniques, from optical methods to analytical scanning transmission electron microscopy, it is possible to determine the distribution and composition of alloy carbonitrides and to deduce at what stage in the complex thermal history they are produced. (5 refs.)

120538 Automated cavity measurement using a region-growing algorithm. J.F.Mancuso (Dept. of Materials Engng., Westinghouse R&D Center, Pittsburgh, PA, USA), H.T.Tai, C.C.Li.
Metallography (USA), vol.16, no.3, p.299-320 (Sept. 1983).
A digital image-processing technique based on a region-growing algorithm for cavity recognition was applied to micrographs of irradiation-induced voids and grain boundary cavities. As long as the resolution of the digitizing process was adequate, cavities were detected with at least an 80% efficiency for applications where illumination, low contrast, diffuse boundaries, and cavity internal structure made conventional analysis difficult. The accuracy of both manual and computer-based size measurements depended on how well boundaries could be defined. Although more work is needed to ensure reliable measurements for the range of conditions expected in materials characterization studies, this technique looks promising as the basis of an automated system for cavity analysis. (7 refs.)

120539 Chemoabrasive polishing of MCT wafers [$Hg_{1-x}Cd_xTe$]. M.Goldstein, A.Horowitz, J.Makovsky (Nuclear Res. Centre, Negev, Beer-Sheva, Israel).
Metallography (USA), vol.16, no.3, p.321-6 (Sept. 1983).
Reports on a chemoabrasive polishing method in which a layer of damaged crystal surface is removed by the simultaneous action of abrasive agents and chemical etching. The quality of the surfaces produced by this method was evaluated and compared to that of surfaces obtained by the accepted lapping-polishing-etching procedure. (5 refs.)

120540 Equilibrium conditions for the average stresses measured by X-rays. I.C.Noyan (Technol. Inst., Northwestern Univ., Evanston, IL, USA).
Metall. Trans. A (USA), vol.14A, no.9, p.1907-14 (Sept. 1983).
True macro-stresses are measured with X-rays after material processing, only if there is a uniform plastic deformation in the sampled volume that is different from that in the rest of the material. In this stress-field the components in the direction of the surface normal are usually negligible over the depth penetrated by X-rays (for example peening). However, pseudo-macrostresses, or backstresses, arise when this condition is violated, for example if there are second phase particles and there is a gradient of plastic deformation from particle to matrix. This pseudo-macrostress field is three-dimensional, and the stresses in the direction of the surface normal can be measured with X-rays. Equations are presented which allow estimates to be made of the magnitudes of the two kinds of stress fields. (25 refs.)

120541 Some informational aspects of the experimental determination of the viscoelastic characteristics of polymeric materials. K.V.Isaev (Sci.-Res. Inst. of Mech. & Appl. Math., Rostov State Univ., Rostov, USSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.648-52 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.977-82 (Nov.-Dec. 1982). [received: Sept. 1983]
It is concluded that when determining the viscoelastic characteristics of polymeric materials, a mismatch in the experimental data of the model used in their analysis, which appears in particular in indeterminacy of estimates of the model parameters, leads to weak extrapolation possibilities of the latter. One of the methods of increasing the effectiveness of experiments consists of optimization of the test loading (deforming) law of the sample according to informational criteria which take into account in the general case the class of loading (deforming) processes of the material to which the experimental data are being extended. In a broader plan the informational criteria permit tying the experimental problem to definite classes of boundary-value problems and thereby posing problems for purposeful experimental investigation. (12 refs.)

120542 New strain standards for glassware stress photoelastic evaluation. T.Kishii (Res. & Dev. Center, Toshiba Corp., Kawasaki, Japan).
Opt. & Laser Technol. (GB), vol.15, no.5, p.253-6 (Oct. 1983).
Strain viewers are used for residual strain evaluation and assessment of glassware. Most viewers are the crossed-nicol type photoelastic apparatus with tint plates, in which the tint colour in the field of view changes with the insertion of strained glassware. Strain standards, which give known or predetermined optical path differences, are necessary for qualitative evaluation of residual internal stress in glassware. Two types of new strain standards, namely rotary-plate type and film-array type, are proposed and presented in detail. (1 ref.)

120543 Revealing structure of thermally sprayed WC-Co 88/12 and NiCrBSi coatings for wear resistance. E.Herrmann (Hoechst AG, Werkstofftech., Frankfurt/Main, Germany).
Prakt. Metallogr. (Germany), vol.20, no.8, p.371-87 (Aug. 1983). In English, German.
Demonstrates that the complicated, multiphase structure of thermally sprayed coatings sometimes requires as a standard procedure the involved contrasting method as well as electron-optical investigations and microanalysis for satisfactory metallographic appraisal. Further detailed investigators in this field are certainly needed to increase our understanding of the relationships between the structure and properties of these coatings and to enable their production and application to be maximized. (6 refs.)

120544 Trials using a SiO_2 dispersion as the polishing agent for metallographic polishing. H.Opielka (Max-Planck-Inst. fur Metallforschung, Inst. fur Werkstoffwissenschaften, Stuttgart, Germany).
Prakt. Metallogr. (Germany), vol.20, no.8, p.388-93 (Aug. 1983). In English, German.
Investigates whether SiO_2 is suitable as a polishing agent for metallographic specimens. Since sufficiently good methods of preparation are known for specimens with average and high hardness only soft and tough materials were selected, together with those that contain a soft phase. Very good results were obtained. These are demonstrated by micrographs. (no refs.)

120545 Magnetic structure analysis. M.N.Mikheev (Inst. of Metal Phys., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.1-8 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.3-12 (Jan. 1983). [received: Oct. 1983]
A review is given of magnetic methods of nondestructive testing of the quality of annealing, hardening, and tempering of steel parts and of the thickness of surface hardened layers in parts developed at the Institute of Metal Physics of the Ural Scientific Center of the Academy of Sciences of the USSR and the equipment used for such inspection is also illustrated. (22 refs.)

120546 Magnetic state of a test specimen demagnetized by an attached horseshoe-shaped electromagnet along the return curve. L.A.Fridman, V.P.Tabachnik, G.S.Chernova (Inst. of Metal Phys., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.8-14 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.12-19 (Jan. 1983). [received: Oct. 1983]
The results of an investigation of the residual magnetic flux and the drop in magnetic potential in the tested part of an article after switching off the demagnetizing current are presented. The calculated data are compared with experimental results. (5 refs.)

120547 A three-coordinate pulsed magnetic analyzer. M.A.Mel'gui, E.A.Shidlovskaya (Inst. of Appl. Phys., Acad. of Sci., Belorussian SSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.14-18 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.19-24 (Jan. 1983). [received: Oct. 1983]
A three-coordinate pulsed magnetic analyzer of the TPMA type designed for the inspection of the mechanical properties of ferromagnetic components, taking into account the anisotropy of structure and form, is described. The results of laboratory tests with the device are presented. (9 refs.)

120548 Ferroprobe flaw detection in alternating magnetic fields with sonic frequency. A.I.Pashagin, V.E.Shcherbinin, G.G.Glinskikh, M.K.Balabanova (Inst. of Metal Phys., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.25-8 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.31-5 (Jan. 1983). [received: Oct. 1983]
Special features of the magnetic ferroprobe method of inspection in magnetizing components with alternating fields with a frequency of up to 10 kHz are examined. Problems associated with the selection of the optimum frequency of the magnetizing field for inspection of components are investigated. The design of a flaw detector for examining the presence of discontinuities on the surface of cylindrical components is described. The results of tests carried out with the detector on hot-rolled rods of ShKh15 steel are presented. (7 refs.)

120549 An electromagnetic structurescope based on the Barkhausen effect. V.N.Moskvin, A.I.Leshchenko (Novosibirsk Electrical Engng. Inst., Novosibirsk, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.29-33 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.35-40 (Jan. 1983). [received: Oct. 1983]
An electromagnetic structurescope, the operation of which is based on the Barkhausen effect, is described. Its functional circuit is presented and the basic units are discussed. (8 refs.)

120550 Finite-element model of two-dimensional problems involving moving objects of inspection. I.G.Leshchenko, G.E.Lustenberg, D.V.Milyaev (S.M. Kirov Tomsk Polytech. Inst., Tomsk, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.33-40 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.41-9 (Jan. 1983). [received: Oct. 1983]
Two-dimensional electromagnetic inspection problems involving parts moving relative to a linear laid-on or a straight-through transducer are considered. An energy functional corresponding to the boundary-value problem in question has been found. The element model necessary for writing a complete system of linear algebraic equations with complex coefficients is obtained as a result of finite-element minimization of the functional. The unknown vector potential values at the nodes of a grid consisting of triangular cells are determined in order to solve this system. (14 refs.)

120551 Microwave eddy-current transducers for monitoring metals. V.D.Ostapenko, N.P.Kalinin (M.I. Kalinin Perm Carburetor Factory, Perm, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.40-4 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.49-53 (Jan. 1983). [received: Oct. 1983]
The general problems involved in constructing microwave transducers, which have not previously been used for flaw detection in metals using the eddy-current method, are considered. New technical solutions employed in practical microwave pickup circuits are described. The input channel of a microwave pickup as the main component which distinguishes it from ordinary high-frequency pickups is considered in detail. The possibility of constructing the proposed transducers in the form of microcircuits based on elements with lumped parameters is pointed out. (3 refs.)

120552 Selecting the control reflectors for flaw detection in welded joints. V.F.Dianov (Krasnyi Kotel'shchik Industrial Union, Taganrog, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.45-9 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.54-9 (Jan. 1983). [received: Oct. 1983]
Equations are derived, and nomograms are plotted for determining the dimensions of cylindrical broadside and corner reflectors equivalent to flat-bottom and flat corner reflectors (notches) of given dimensions. A procedure is proposed for determining the equivalent diameter of an extended flaw in a welded joint. The influence of the length of flaws on their detectability in ultrasonic weld inspection is estimated. (11 refs.)

120553 Analysis of the errors of location of acoustic-emission sources for one-dimensional objects. B.Ya.Maslov, A.M.Vasil'ev.
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.49-53 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.59-64 (Jan. 1983). [received: Oct. 1983]
The errors associated with noncorrespondence between the true and calculated values of the propagation velocity of acoustic-emission waves recorded by the receiving channels and with the error of measurement of the differences in the arrival times of the waves at the receiving transducers for various numbers and placements of the latter are considered. Error graphs are given. (2 refs.)

120554 Acoustic emission during short-term creep of fiberglass plastics. A.Yu.Detkov, N.A.Glukhov (All-Union Sci.-Res. Inst. of Nondestructive Testing, Kishinev, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.54-7 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.64-8 (Jan. 1983). [received: Oct. 1983]
Results are presented from studies to determine the effect of a steadily applied load on the fault-rate processes of fiberglass plastics as registered by acoustic-emission apparatus. It is shown that the material 'remembers' the previous loading history. (3 refs.)

120555 Signal-to-noise ratio at the output of a flaw detector with a mosaic semiconductor hard X-ray detector and digital signal processing. N.Yu.Gerasenov, I.M.Rubinovich (Electronic Flaw-Detection Res. Inst., Tomsk, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.58-64 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.69-77 (Jan. 1983). [received: Oct. 1983]
Expressions are derived for the signal, the background, and the noise at a silicon detector concerned with steel components and X-rays of maximum quantum energy 30 MeV. Estimates are made of the noise arising from fluctuations in the number of carriers multiplied in the detector and also of the generation-recombination and thermal noise. Expressions are given for the signal-to-noise ratio at the output of a flaw detector with digital data processing, which works with or without adaptation to the radiation flux. There is an advantage in a system that adapts to a static radiation flux. Relationships are given for this for the signal-to-noise ratio in relation to the quantization step for the correcting current, which enable one to relate the parameters of the digital system to those of the detector and to the monitoring sensitivity. (11 refs.)

120556 Calculation of surface-scattered optical fields in designing optical scanning devices. E.M.Salmina (Novosibirsk Electrotech. Inst., Novosibirsk, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.65-9 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.77-83 (Jan. 1983). [received: Oct. 1983]
A method is given for calculating the two-dimensional optical fields scattered by acceptable and defective surfaces for various working conditions in the illumination and receiving devices; this is based on the theory of wave scattering at a statistically uneven surface (tangential-plane method) with piecewise-linear defect relief description. A comparison is made of theoretical and experimental results and an estimate is made of the calculation error. The method can be used in optimizing the optical systems of scanning flaw detectors. (4 refs.)

120557 Analytic properties of the reflection coefficient for a layered dielectric structure in wide-band UHF flaw detection. A.M.Akhmetshin (Dnepropetrovsk Univ., Dnepropetrovsk, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.70-7 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.83-93 (Jan. 1983). [received: Oct. 1983]
Recovery of the phase response for the reflection coefficient is considered on the basis of measurement of the modulus over a wide frequency range in the monitoring of one-layer and two-layer insulating structures. Results from numerical simulation and an actual test are considered. (9 refs.)

120558 A tracking device for stabilizing the pressure of a transducer on a workpiece during scanning. V.S.Gromov (Leningrad Engng. Construction Inst., Leningrad, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.1, p.77-9 (Jan. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.1, p.93-6 (Jan. 1983). [received: Oct. 1983]
The design of mechanical scanning systems is particularly important in the use of nondestructive test methods, particularly with application to objects of various shapes. The effector mechanism is very important, since this carries the detector, and its functions include stabilizing the pressure on the workpiece. The tracking carrier with a two-arm lever is a simple and reliable device meeting the major requirements of the monitoring: stabilizing the pressure on the surface and constant distance from the surface to the transducer. The carrier can be used as an additional device in a scanner for bodies of rotation for surfaces of various shapes. When the body is a cylinder or cone, the effector mechanism in tracking device will describe a path similar to that of the generator corresponding to the object. This design of carrier mechanism has been used in an apparatus for testing spherical shells and has been introduced at Lensovet Technological Institute in Leningrad. The scanning mechanism of this design performs a motion in the meridional plane of a sphere and provides the necessary technological parameters. This upgraded apparatus eliminates manual work from the monitoring operations for spherical shells, which greatly improves labor productivity and the performance in monitoring these shells. (7 refs.)

120559 Relation between the actual and nominal boundaries of an extended defect in ultrasonic examination of a thick sheet. A.S.Golubev, S.K.Pavros, S.V.Mamistov (Ul'yanov Leningrad Electrotech. Inst., Leningrad, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.81-4 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.3-7 (Feb. 1983). [received: Oct. 1983]
There is a relationship between the position of the edge of an opaque half plane and the amplitudes of the shadow and echo signals, which is dependent on the wave parameters of the acoustic system and the monitoring sensitivity. (7 refs.)

120560 Attenuation of ultrasound in steels with a homogeneous structure. V.L.Busov (Sci.-Res. & Design Technol. Inst. of Engng., Kramatorsk, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.87-93 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.11-18 (Feb. 1983). [received: Oct. 1983]
The total scattering cross section and the effective backscattering cross section at volume heterogeneities of an arbitrary scale are determined theoretically for carbon and low-alloy steels with an attenuation factor of ultrasonic waves of 1-10 dB/m. The scale of the volume heterogeneities of the propagation velocity of ultrasound is evaluated. The results are compared with the results obtained on the basis of the existing attenuation theories. (9 refs.)

120561 Measuring procedure for the physical and mechanical characteristics of thin rods and wires using the ultrasonic resonance method. V.G.Meierson.
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.93-9 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.19-26 (Feb. 1983). [received: Oct. 1983]
Based on an improved theory for the flexural vibrations of a rod, a procedure has been developed that makes it possible to determine the characteristics of a rod when its length and the tensile force on it are given, namely, the transverse dimensions, the flexural rigidity and the radius of the moment of inertia of the cross-sectional area, the mass and density of the material, Young's modulus, the shear modulus, Poisson's ratio, and the transverse and longitudinal strains of the object under tension. Generalized experimental criteria are established for the correspondence between the properties of a rod and its model. Consideration is given to the effect of compensating for the influence of inertia on the flexural vibrations of the rod, and to the possibility of utilizing this effect for checking the rods. The results of experimental studies are presented. (8 refs.)

120562 Location information of acoustic-emission signals. O.I.Khol'kin.
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.105-11 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.32-40 (Feb. 1983). [received: Oct. 1983]
Based on an examination of amplitude-spatial diagrams for sources of acoustic-emission signals it is shown that when the receiving points are spaced too widely, there will be dead zones not only for the location but also the detection of useful signals. Formulas are derived for calculating the maximal permissible distances between receiving points for the inspection of one-dimensional and two-dimensional objects. Relationships are given for finding the probabilities of occurrence of undetectable acoustic-emission signals, of those that give no location information, and those that do when sites of the radiation points are fixed and random. (6 refs.)

120563 Special features of the ultrasonic inspection of purity of aluminum A9999. L.A.Yakovlev, E.K.Guseva, Yu.I.Belyakov, M.L.Khavkin (V.I. Ul'yanov Electrotech. Inst., Leningrad, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.111-12 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.40-1 (Feb. 1983). [received: Oct. 1983]
Examines the possibilities of the ultrasonic method with resonance measurements in the kilohertz frequency range. As indicated by the dislocation theory of internal friction, the selected frequencies should result in the maximum sensitivity. (5 refs.)

120564 Detectability of defects in inspection with ultrasonic inclined transducers made of organic glass and caprolon. B.S.Svyat-skii, M.I.Apakhov, L.A.Tryapkina.
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.113-14 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.41-2 (Feb. 1983). [received: Oct. 1983]
Comparative investigations of the detectability of defects were carried out on a 30-mm-thick plane-parallel steel specimen. The reflector was irradiated many times (20 times) with the direct beam at various sensitivity levels using standard transducers with the prism made of organic glass and caprolon. The working frequency of the transducers was 2.5 MHz; the prism angle was 40°. The model of the defect was represented by a vertical drilled hole 1.5 mm in

diameter and 5 mm long. The number of detections of the reference reflector was recorded in inspection at various sensitivity levels above the reference level. In inspection with the transducer made of organic glass at the reference inspection level, the signal from the reflector was obtained in 20% of cases. To ensure 100% detection of the reflector, the sensitivity would have to be increased to 4 dB. In irradiation with the caprolon transducer at the reference sensitivity level, the detectability is equal to only 10% and the required increase of sensitivity for scanning should not be lower than 9 dB. (2 refs.)

120565 Mechanism of visualization of inclusions in dielectrics using the gas discharge. V.N.Balakshin, A.M.Tivkov, V.I.Fel'dman.
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.115-18 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.43-6 (Feb. 1983). [received: Oct. 1983]
The possible mechanism of visualization of heterogeneities in dielectric materials using the gas discharge is examined. The possibilities of visualization of inclusions in the dielectrics are linked with the distortion of the electrostatic field in the dielectric in the presence of an inclusion and by the effect of this distortion on the secondary emission characteristics dependent on the field. It is assumed that the 'image' is formed by the secondary electrons as a result of secondary ion-electron emission (SIEE). Fields are calculated for a planar geometry approximated to the conditions of visualization in the gas discharge for various parameters of the inclusion of its position in the dielectric. On the basis of the calculation results, it may be concluded that the proposed mechanism is in qualitative agreement with the experimental data. (8 refs.)

120566 Visualization of fatigue defects by an electrodischarge high-frequency method. S.V.Dezhkunova, A.G.Dovgyallo (Inst. of Appl Phys., Acad. of Sci., Belorussian SSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.118-21 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.46-50 (Feb. 1983). [received: Oct. 1983]
The detectability of fatigue defects in components made of D16 alloy and also in full-size specimens of steel 45, titanium VT-1, and D16 alloy by an electrodischarge high-frequency method was examined. It is shown that the method makes it possible to detect point corrosion and also cracks hidden below paint and varnish coatings. (4 refs.)

120567 Radiowave inspection of the properties of dielectrics. E.F.Kondrat'ev, A.V.Pets, B.V.Karasev (Kaliningrad State Univ., Kaliningrad, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.121-3 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.50-1 (Feb. 1983). [received: Oct. 1983]
UHF radiowave methods can be used for checking and measuring many properties of dielectrics connected with the magnitude of the real and the imaginary part of dielectric permeability: humidity; chemical composition, structural state, dimensions, etc. The authors describe one of the simplest methods the one based on measuring the characteristics of a standing electromagnetic wave in a measuring line loaded onto a cell filled with the investigated material. The probe of the measuring line is placed at the points of maximum and minimum of the standing wave, and then the modulus Γ and the phase ϕ of the reflection coefficient are determined, the results being compared with the previously plotted calibration curves of the functions $\Gamma(W)$ and $\phi(W)$, where W is a magnitude characterizing the property to be inspected. In automatic inspection the electric signal from the detector is transmitted to the system for correction of the phase shift which retunes the line in such a way that the probe is located constantly at the maximum of the standing wave. (1 ref.)

120568 Improving the accuracy of magnetic inspection of the mechanical properties of high-quality steel. L.D.Devyatchenko, L.E.Valyaeva (G.I. Nosov Magnitogorsk Mining & Metall. Inst., USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.124-8 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.52-7 (Feb. 1983). [received: Oct. 1983]
Examines ways of improving the mathematical model of the inspection of the mechanical properties of high-quality carbon steel using a magnetic-pulse analyzer IMA-2A, a ferrosonde coercimeter KIFM-1M, and a contact hardness tester TK-1M. It was established that inclusion of technological production factors of the steel, and of its chemical composition in the model considerably improves the quality of the approximation in nondestructive magnetic inspection of metal production. (4 refs.)

120569 Possibilities of utilizing the Hall effect in the magnetic structural analysis of heat-treated steels. E.S.Gorkunov, B.M.Lapidus, G.Ya.Batinova (Inst. of Metals., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.137-41 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.66-71 (Feb. 1983). [received: Oct. 1983]
Structural steels 30KhGSA, 34KhN3M, 40Kh, SP-28, and alloy steel 3Kh13 were used to examine the relationships governing the variation of the Hall EMF in various tempering conditions, and to show the possibilities of using this characteristic of the magnetic structural analysis of heat-treated steels. (12 refs.)

120570 Examination of the magnetic, electrical, and mechanical properties of thermoelectrode materials based on nickel. G.V.Bida, R.A.Vafin (Inst. of Metals Phys., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.141-4 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.71-4 (Feb. 1983). [received: Oct. 1983]
It is shown that nondestructive magnetic inspection can be used to examine the service properties of thermoelectrode materials Alumel, SA, NK, and NKM. (8 refs.)

120571 Magnetic fields of surface flaws with combined magnetization of products. A.I.Pashagin, V.E.Shcherbinin, S.A.Donskoi (Inst. of Metals Phys., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.144-50 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.75-81 (Feb. 1983). [received: Oct. 1983]
Examines the magnetic fields of flaws on the outer surface when products are magnetized simultaneously by an alternating and constant magnetic field whose vectors are parallel. The AC and constant components of the field of the flaw are measured, and it is shown that there exists an optimum region of constant magnetizing fields in which the sensitivity of the magnetic method of control by the AC compound magnetizing fields in which the sensitivity of the magnetic method of control by the AC component is maximal. The intensity of the constant magnetic field at which the AC component of the field of the flaw is maximal depends on the ratio of the amplitudes of the alternating and constant field, and also on the dimensions of the flaws. (5 refs.)

120572 Metrological provisions for magnetic and eddy-current means of nondestructive inspection. A.P.Vashchekina, L.A.Rubinshtein.
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.151-4 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.81-6 (Feb. 1983). [received: Oct. 1983]
Describes the present state and level of metrological provisions for magnetic and eddy-current means of nondestructive inspection in the USSR. It explains the basic trends of further improvement of the metrological provisions for these means, the compilation of technical standard documentation and test equipment. (2 refs.)

120573 Effect of porosity and phase composition on the magnetic properties of sintered structural steel ZhGr1D2.5K0.4. A.I.Ul'yanov, G.V.Sterkhov, V.G.Ermolaev, A.V.Zagainov (Inst. of Metals Phys., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.155-7 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.86-8 (Feb. 1983). [received: Oct. 1983]
Present the results of investigations into the magnetic properties of sintered structural steel ZhGr1D2.5K0.4 used for the manufacture of plain bearings. Measurements were taken in a closed magnetic circuit in the complete and partial cycles of the magnetic hysteresis loop on specimens in the form of rings with an internal diameter of 32.35 mm, an external diameter of 38.75 mm, and a height of 10 mm. The winding wound on the ring made it possible to take measurements in a magnetic field of up to 300 A/cm. The hysteresis loops were recorded in a two-coordinate automatic recording device, using an F-190 microwebermeter as an integrating device. (6 refs.)

120574 Possibilities of the nondestructive magnetic inspection of hardness of 32Kh2NVMBR high-strength steel. N.N.Zatsepin, P.P.Astashenko, N.A.Potapova, V.D.Kaverin, T.M.Smirnova (Inst. of Appl. Phys., Acad. of Sci., Belorussian SSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.158-9 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.89-90 (Feb. 1983). [received: Oct. 1983]
To examine the possibilities of magnetic inspection of the mechanical properties of 32Kh2NVMBR high-strength steel, investigations were conducted into the effect of heat treatment on the magnetic properties and hardness of the steel. The magnetic properties of the steel (coercive force H_c, remanent induction of the body B_d, maximum magnetic permeability μ_{max}, saturation magnetization M_s) were measured in BU-3 ballistic equipment. The maximum magnetizing field was 40000 A/m. The specimens of the steel were heat-treated in the following conditions: oil quenching from 940°C, tempering at 150-500°C. The HRC hardness of the specimens was measured by the Rockwell method. The dependence of the magnetic properties on temperature is given. An increase of tempering temperature from 150 to 500°C reduces hardness, coercive force, and remanent induction of the body, whereas the maximum magnetic permeability increases. Saturation magnetization rapidly increases in the tempering temperature range 150-350°C, reaches the maximum value at 350°C, and then slowly decreases. (4 refs.)

120575 Automating radiometric monitoring. A.S.Chekalin, A.K.Temnik, G.E.Butakova, V.I.Goncharov (Electronic Flaw Detection Res. Inst., Tomsk, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.160-2 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.91-4 (Feb. 1983). [received: Oct. 1983]
Defines the basic specifications that an automatic radiometric system (ARS) must meet in monitoring components of complicated shape, and describes an existing automatic system that works in conjunction with an RD-10R multichannel γ-ray flaw detector. (4 refs.)

120576 Optimizing X-raying of steel items. V.P.Lopaev, P.M.Kravtsov (Atomkotlomash Production Cooperative, Rostov-on-Don, USSR).
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.162-3 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.94-5 (Feb. 1983). [received: Oct. 1983]
It is useful to employ X-ray equipment in monitoring power-engineering items, and it is therefore of interest to examine the conditions for maximum sensitivity for continuous-spectrum sources when there is scattering in the material. Experimental studies have been made on the relative sensitivity for radioscopic systems of Introscope type, which have shown that the optimum energy agrees to ±10% with the calculated value for various steel thicknesses. The dependence of the optimum X-ray energy on the steel thickness can be utilized in constructing RS with automatic tube voltage regulation. (4 refs.)

120577 Use of FT-41 phototechnical film in X-ray examination. A.M.Sabadash, Ya.M.Ravlik, V.I.Dzhim.
Sov. J. Nondestr. Test. (USA), vol.19, no.2, p.164 (Feb. 1983). Translation of: *Defektoskopiya (USSR)*, vol.19, no.2, p.95-6 (Feb. 1983). [received: Oct. 1983]
RT-5 film, which is a high-contrast unscrewed film of fine-grained type, is widely used in X-ray monitoring of castings and welded joints in aluminum, titanium, and magnesium alloys. However, this film is expensive on account of its high silver content, as there is emulsion on both sides. If very high resolution is required one should use single-layer films, but with an increased layer thickness. Such X-ray films are not at present commercially available, so the authors have investigated FT-41 phototechnical film for X-ray use, which has a single light-sensitive layer. The experiments indicate the limits to the use of FT-41 film for certain thicknesses. Within the specifications in the standardization documentation, FT-41 film can replace RT-5 for X-ray testing of aluminum-base alloys of thickness from 1.5 to 30 mm, magnesium ones from 4 to 50 mm, and titanium ones from 0.5 to 5 mm. (4 refs.)

120578 Dynamic fracture toughness of structural steels by instrumented charpy test. J.Namekata (Dept. of Mech. Engng., Nat. Defense Acad., Yokosuka, Japan), K.Sasaki, S.Shioya.
Sci. & Eng. Rep. Natl. Def. Acad. (Jpn.) (Japan), vol.20, no.4, p.383-99 (Dec. 1982). In Japanese. [received: Sept. 1983]
The dynamic fracture toughness ($K_C{}^d$) of three kinds of structural steels (SM50, WT 60 and WT80) has been evaluated by means of instrumented charpy test in the temperature range of $-40-+95$°C. The results obtained in this study are summarized as follows: (1) $K_C{}^d$ obtained from equivalent energy method shows a clear ductile-brittle transition behaviour for SM50 and WT60, but transition behaviour for WT80 was not clearly shown; (2) the value of $K_C{}^d$ from instrumented charpy test is effective in an area of brittleness and a limited area of ductile-brittle transition—however it is extremely difficult to estimate $K_C{}^d$ of large structural steel from the result of small charpy specimen testing at comparable high temperature on account of the problems of thick effectiveness and crack-initiation site; (3) $K_C{}^d(J)$ obtained from Rice's J integration value are nearly equal to $K_C{}^d$, so both analyses can show the value of the dynamic fracture toughness; and (4) the $K_C{}^d$ transition curve depends on sharpness of the notch's tip. (18 refs.)

120579 Roller bearing fatigue tester. S.Simandiri (Ampol Res. & Dev. Lab., Wynnum, Queensland, Australia).
Trans. Inst. Eng. Aust. Mech. Eng. (Australia), vol.ME8, no.1, p.1-7 (June 1983).
A rolling fatigue tester was built and used to evaluate fatigue lives of roller bearings. It is operated using a full-scale roller bearing housed in a lubricant chamber. The bearing inner race is driven by a drive shaft and its outer race is permitted to rotate in the housing by means of free fitting such as in floating ring bearings. The roller retainer ring is kept stationary using three retainer pins which are integral parts of the housing. This design permits the rollers to roll around the races but not to orbit about the shaft. Hence, half rollers at the lower part of the bearing are continuously loaded unidirectionally, providing an accelerated test which is aimed at simulating the roller bearings in hydraulic pumps. (7 refs.)

120580 Laboratory evaluation of the on-line Ferrograph. P.W.Centers (Aero Propulsion Lab., Wright-Patterson Air Force Base, OH, USA).
Wear (Switzerland), vol.90, no.1, p.1-9 (15 Sept. 1983). (First International Conference on Advances in Ferrography, Swansea, Wales, 22-24 Sept. 1982).
A laboratory evaluation of the on-line Ferrograph for fluids containing well-characterized debris indicates that the wear concentration, as measured by the instrument, is unaffected by variation in fluid pressure (0.21-0.65 MPa (absolute); 30-80 lbf in^{-2} (gauge)) and temperature (65-99°C) within the range examined, that the difference between L, the concentration of large debris particles, and S, the concentration of small debris particles, describes the severity of wear and that changes in debris concentration at or near the level of 1 ppm can be detected. Correlation of on-line and analytical ferrographic data was apparent; such correlation was not found for spectrometric oil analysis, colorimetric iron analysis or particle count data. Start-up and low fluid temperature problems encountered with the unit may be avoided by sensor insulation and preheating. Additional field evaluations are required to determine suitability for many potential applications. (10 refs.)

120581 Continuous wear measurement by on-line ferrography. W.Holzhauer, S.F.Murray (Dept. of Mech. Engng., Rensselaer Polytech. Inst., Troy, NY, USA).
Wear (Switzerland), vol.90, no.!, p.11-19 (15 Sept. 1983). (First International Conference on Advances in Ferrography, Swansea, Wales, 22-24 Sept. 1982).
An on-line Ferrograph was used to monitor the wear rates of oil-lubricated ball-bearings. Periodically, the test bearings were also removed from the test stand and cleaned and weighed on an analytical balance. A comparison of the mass loss data obtained by each of these two methods showed that the Ferrograph readings did provide on-line quantitative wear data for each individual test. However, the rates at which the ball-bearings wore were not consistent from test to test. For the four ball-bearings that were evaluated, plots of the Ferrograph concentration readings versus bearing mass loss gave slopes that varied between 1.1 and 2.5. Nevertheless, the results showed that semiquantitative data on the wear rates of machine components could be obtained with this on-line instrumentation. (2 refs.)

120582 The deleterious effect arising from preparation of ferrograms in ferrography and the consequences in subsequent analysis of wear particulates. D.G.Jones (Ruthana-Tribo-Tech. Ltd., Swansea, Wales), O.K.Kwon, D.A.Vaughan.
Wear (Switzerland), vol.90, no.1, p.63-73 (15 Sept. 1983). (First International Conference on Advances in Ferrography, Swansea, Wales, 22-24 Sept. 1982).
The resolution of problems arising from the existing ferrography machine in the ferrographic deposition of wear particles is considered as a relevant prerequisite for the qualitative and quantitative analysis relating to the correct interpretation of the wear behaviour in lubricated systems. Crushing, shattering and polishing actions of wear particles generated from a lubricating system were confirmed to have occurred during preparation of Ferrograms when the existing ferrography machine was used because of the squeezing action of the peristaltic pump. Some polymer-like material, e.g. trichites, tubules and glassy flake materials, were entrapped inside the polytetrafluoroethylene (PTFE) tube where the PTFE tube was compressed by the pump. Severe cutting abrasive wear occurred on the inside wall of the PTFE tube as the wear particles passed through. The greater the tube diameter or wall thickness, the more the wear particles were reduced in size. The polishing action on the particles which accompanied this activity was also confirmed. (6 refs.)

120583 Wear studies through particle size distribution. II. Multiple field analysis in ferrography. B.J.Roylance, D.A.Vaughan (Dept. of Mech. Engng., Univ. College of Swansea, Swansea, Wales).
Wear (Switzerland), vol.90, no.1, p.137-47 (15 Sept. 1983). (First International Conference on Advances in Ferrography, Swansea, Wales, 22-24 Sept. 1982).
For pt.I see ibid., vol.90, no.1, p.113-36 (1983). Further developments in techniques used to analyse wear particle size distributions are described. Cumulative counting of particles from different positions along the Ferrogram slide permits the use of an appropriate significance test to determine the transition from one mode of wear to another. (4 refs.)

120584 The singularity expansion method as applied to the elastodynamic scattering problem. G.Bollig, K.J.Langenberg (Fraunhofer-Inst. fur Zerstorungsfreie Prufverfahren, Univ. des Saarlandes, Saarbrucken, Germany).
Wave Motion (Netherlands), vol.5, no.4, p.331-54 (Aug. 1983).
A basic problem in nondestructive testing of materials is the classification of defects with respect to size and geometry. Utilizing elastodynamic scattering, ultrasonic test methods reduce this problem either to the application of reconstruction algorithms or to the parametrization of experimental data in terms of quantities being related to the physical scattering mechanisms. The so-called Singularity Expansion Method (SEM) proves essentially useful to predict and understand impulsive scattering of ultrasound; in addition, even though not yet fully solved in practice, it seems possible to parametrize experimentally obtained time records in a sense which is physically intuitive. Several theoretically derived singularity patterns are presented for various body shapes and material compositions, which yield a thorough and physically intuitive interpretation in terms of distinct creeping wave modes. They are compared with experimental results for a spherical void in a steel test specimen. (51 refs.)

120585 Light-microscopical analysis of nitrided or nitrocarburized iron and steels. P.F.Colijn, E.J.Mittemeijer, H.C.F.Rozendaal (Lab. of Metall., Delft Univ. of Technol., Delft, Netherlands).
Z. Metallkd. (Germany), vol.74, no.9, p.620-7 (Sept. 1983).
Methods for the light-microscopical analysis of compound layers and diffusion zones of nitrided or nitrocarburized iron and steels are presented. Applied variants comprise Nital, Murakami and interference etching in combination with bright-field, polarized-light or phase-contrast microscopy. Quantitative confirmation of qualitative results from light microscopical analysis is provided by electron-microprobe and X-ray diffraction analyses. (19 refs.)

120586 Eddy current measuring devices for automatic detection of material defects in strands during the casting process. B.Christmann, J.Weber (AEG Telefunken, Berlin, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.419-25 vol.1
Problems encountered in the detection of material cracks on glowing slab strands during continuous casting of steel due to the adverse conditions such as high temperature and scaling are outlined. Eddy current sensors were developed for determination of surface cracks. Tests carried out with models as well as those carried out in continuous casting plants were successful. (4 refs.)

120587 Testing and quality control of materials by microstructure analysis. M.Hajnal (Dept. of Process Control, Tech. Univ. of Budapest, Budapest, Hungary), M.Konyves-Toth, T.Reti.
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.283-92 vol.3
Automatic control of quality in production and research is dealt with. A combined approach based on both geometrical-topological and statistical features of the micrographs is presented whose main aim is to perform their analysis and classification. As application example, recognition of the distribution of graphite flakes in gray cast iron, is given to show that the method developed is suitable for testing and automatic classification of materials. (11 refs.)

120588 Advances in surface inspection using on-line image processing. T.J.Ellis, W.J.Hill, L.Finkelstein (Dept. of Phys., City Univ. of London, London, England).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.409-18 vol.3
Automatic optical surface inspection of plain flat surfaces is dealt with. Sophisticated information processing is required for this inspection task, and a system has been developed and evaluated for cold-rolled steel strip via extensive studies in computer simulation, using interactive colour graphics terminals. The system incorporates a laser scanner with multiple sensors of the scattered light field from the surface. Surface defect signals are detected on each signal channel with a bank of matched filters, and then subjected to a hierarchy of processing operations for delineation (i.e. boundary extraction), parameterisation, and identification of the defect type. The techniques of image processing and automatic pattern recognition are employed. (4 refs.)

120589 Ultrasonic fractography of glassy polymers. K.Takahashi, K.Matsushige, Y.Sakurada (Res. Inst. for Appl. Mech., Kyushu Univ., Fukuoka, Japan).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.34/1-6
A comparison is made concerning the fracture velocity values for PMMA and epoxy simultaneously obtained by the method based on ultrasonic fractography and by high speed photography. A satisfactory agreement is obtained, which confirms applicability of ultrasonic fractography to viscoelastic materials. Some application examples are shown, related to fracture velocity measurements at an initial stage of fast crack propagation and crack arrest. (9 refs.)

120590 Residual stresses in plastics pipes. J.M.Hodgkinson, J.G.Williams (Dept. of Mech. Engng., Imperial Coll., London, England).
Proceedings of the 5th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, England, 29 March-1 April 1982 (London, England: Plastics & Rubber Inst. 1982), p.35/1-7
The determination of residual stresses in six samples of plastics pipe is described using a layer removal method and measuring either deflection on slitting or the opening bending moment. These results are compared with a thin ring method and it is concluded that the layer method using the moment and outside machining is the best. The ratios of the measured stresses indicate that the sizing die is the controlling factor in cooling and the stress magnitudes are strongly influenced by the cooling temperature. (3 refs.)

First International Conference on Advances in Ferrography ..See Entry 116927

Radiation field of a plane waveguide into an elastic space .....See Entry 117165

Elements of thermography for nondestructive testing ....See Entry 117173

Inspection of the magnetic properties of carriers of magnetic recording ....See Entry 117205

Quantitative serial sectioning analysis: preview ....See Entry 117228

Distribution-free estimation of sphere size distributions from slabs showing overprotection and truncation, with a review of previous methods ....See Entry 117229

An in situ slow extension rate fracture stage for Auger electron spectroscopy ....See Entry 117282

Evaluating radiographic systems using the resolving power function ....See Entry 117303

Measurement of curvature and bending stiffness of thin carbon composite plates using holographic interferometry ....See Entry 118099

Voltage and current amplifiers in ultrasonic equipment ....See Entry 118340

Predicting the creep of unidirectional reinforced plastic with thermorheologically simple structural components ....See Entry 118539

Scattering of elastic waves from simple defects in solids, a review ....See Entry 119008

Stress dependence of magnetically induced ultrasonic shear wave velocity change in polycrystalline A-36 steel ....See Entry 119111

Selective dissolution of dendritic or interdendritic phase in Sn-Al alloys ....See Entry 119212

The annihilation of the positron: a nondestructive research tool ....See Entry 120178

The determination of crystallographic textures from selected areas of a specimen by electron diffraction .... See Entry 120348

Failure mechanism discrimination in carbon fibre-reinforced epoxy composites ....See Entry 120399

The role of wear debris in the study of wear ....See Entry 120451

Wear studies through particle size distribution. I Application of the Weibull distribution to ferrography ....See Entry 120452

The contribution of particle analysis to the study of wear of metals .... See Entry 120453

Microsctructure and composition of borided refractory metals .... See Entry 120512

81.90 OTHER TOPICS IN MATERIALS SCIENCE

120591 Enhancement of the mechanical adhesion between the surface of fillers and plasticized PVC matrix. W.Dahlig (Politech. Warszawska, Warsaw, Poland), W.Janczak.
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.4, p.120-2 (April 1983). In Polish. [received: Oct. 1983]
To enhance the mechanical adhesion during preparation of PVC compounds, polymer solutions of various concentration in a plasticizer have been used, these solutions being mixed with fillers. It has been found that the application of a polymer solution of appropriate concentration lowers the frictional drag of plasticizing, improves the mechanical properties and lowers the plasticizer extraction. (9 refs.)

Adhesive contact of sectionally smooth-ended punches on elastic half-spaces: theory and experiment .... See Entry 118531

82.00 PHYSICAL CHEMISTRY

82.20 CHEMICAL KINETICS

MINDO/3 study of the hydrogen insertions of cyclopropenylidene and cyclopropylidene .... See Entry 117780

Doping kinetics of polyacetylene in the short range .... See Entry 119042

Kinetics of $TiSi_2$ formation by thin Ti films on Si .... See Entry 119280

The rate of the reactions of C_2O radicals with H and H_2 .... See Entry 120594

Determination of rate constants for some reactions of CBr radicals by VUV laser flash photolysis .... See Entry 120599

Models for the kinetics of cis-trans isomerization in polyacetylenes .... See Entry 120610

Stability of iodine-doped polyacetylene in aqueous environments .... See Entry 120612

Location of transition states and stable intermediates by MINIMAX/MINIMI optimization of synchronous transit pathways .... See Entry 120624

Molecular weight and kinetics of acetylene polymerization .... See Entry 120631

State correlation diagrams for the photochemical reactions of organometallics .... See Entry 120662

82.20K Potential energy surfaces for chemical reactions

(see also 31.70F -in atomic and molecular physics, 34.20 Intermolecular forces, 34.50L Atomic and molecular beam studies)

A theoretical analysis of the relative roles of ground and excited states in the bond rupture and hydrogen migration pathways in ethyl and vinyl radicals .... See Entry 120593

82.20M Nonequilibrium kinetics

Chemical applications of topology and group theory. XIV. Topological aspects of chaotic chemical reactions .... See Entry 120625

82.20R Energy distribution and transfer, relaxation

(see also 31.70H Time-dependent phenomena in atomic and molecular physics)

$OH(X^2\Pi)$ state distribution from HNO_3 and H_2O_2 photodissociation at 193 nm .... See Entry 120653

82.30 SPECIFIC CHEMICAL REACTIONS; REACTION MECHANISMS

120592 Catalyzed and inhibited decomposition of ammonium perchlorate. R.P.Rastogi, A.P.Rao, V.Syal (Gorakhpur Univ., Gorakhpur, India).
AIAA J. (USA), vol.21, no.9, p.1351-2 (Sept. 1983).
There has been active interest in recent years in the study of thermal decomposition of ammonium perchlorate (AP) in the presence of catalysts and inhibitors because of its importance in solid-propellant rockets. Some recent studies have shown that for composite propellants at atmospheric pressure carbonates are more effective burning rate catalysts than oxides of chromium and copper and that calcium oxide and carbonates of calcium, barium, and strontium act as burning rate inhibitors. From the viewpoint of rocket technology, it is desirable to investigate how these catalysts and inhibitors influence the thermal decomposition of AP. This is particularly important in view of the recent finding that the data on AP decomposition for different temperature ranges and for different particle sizes can be represented by the general equation $d\alpha/dt = a\alpha - b\alpha^2/1 + d\alpha$, where a, b and d are constants. α is the fraction decomposed at time t. The authors make a comparative study of catalysts and inhibitors in order to investigate how they affect the values of a, b, and d. (23 refs.)

120593 A theoretical analysis of the relative roles of ground and excited states in the bond rupture and hydrogen migration pathways in ethyl and vinyl radicals. A.Sevin, H.T.Yu (Lab de Chimie Organique Theorique, Paris, France), E.M.Evleth.
THEOCHEM (Netherlands), vol.13, no.1-2, p.163-78 (Sept. 1983).
Ab initio SCF+CI calculations of the potential energy surfaces for bond rupture and hydrogen-migration pathways are presented for the ground and excited states of ethyl and vinyl radicals. For the ground state surfaces various methodological problems are discussed with regard to the use of single configuration RHF and UHF open-shell techniques. The relationship between the ground and excited state surfaces is clearly delineated using orbital and state correlation diagrams. The essentials of these qualitative diagrams are reproduced at the computational level. The main feature of the excited state migration pathway is that there exists a direct C_{2V} adiabatic pathway taking the excited states of ethyl and vinyl radicals to the ground states of ethylene and acetylene+H, respectively. However, only in the case of the vinyl radical is this pathway energetically feasible. In the case of the vinyl radical, the presence of low lying excited states and subsequent high barriers indicates that excited vinyl radicals should be stable. However, the excited states of ethyl and other related alkyl radicals should be directly photodissociative or predissociative. (49 refs.)

120594 The rate of the reactions of C_2O radicals with H and H_2. O.Horie, W.Bauer, R.Meuser, V.H.Schmidt, K.H.Becker (Phys. Chem., Bergische Univ. Gesamthochschule Wuppertal, Wuppertal, Germany).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.251-4 (9 Sept. 1983).
The rate constants for the reactions $C_2O+H \rightarrow$ products (1) and $C_2O+H_2 \rightarrow$ products (2) have been determined at room temperature by means of laser-induced fluorescence detection of C_2O radicals, generated either by the KrF excimer laser photolysis of C_3O_2, or by the reaction of C_3O_2 with O atoms. Values of $k_1=(3.7\pm1.0)\times10^{-11}$ cm^3 s^{-1} and $k_2=(7\pm3)\times10^{-13}$ cm^3 s^{-1} were obtained. (14 refs.)

120595 The effect of a magnetic field on the product yield of a geminate radical-pair reaction in homogeneous solution. H.Fischer (Phys. Chem. Inst., Univ. Zurich, Zurich, Switzerland).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.255-8 (9 Sept. 1983).
The yield of pivalaldehyde, a cage product of the photolysis of di-tert-butyl ketone, has been studied in *n*-decane at 68°C as a function of the external magnetic-field strength, $0 \leq B \leq 9000$ G. A small increase at low field and a substantial decrease at higher fields are explained quantitatively in terms of the radical-pair theory, employing known magnetic and diffusion parameters of the geminate pivaloyl/tert-butyl radical pair. Non-geminate reaction products do not show magnetic-field dependent yields. (27 refs.)

120596 Charge transfer in polar media. Transition-state entropy. Y.I.Dakhnovskii, A.A.Ovchinnikov (Inst. of Chem. Phys., Acad. of Sci., Moscow, USSR).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.17-27 (Oct. 1983).
The theory of charge (electron, proton and other ions) transfer chemical reactions in polar media is considered. Within the semiclassical approximation the transition-state entropy is derived for an arbitrarily large term splitting. The dependence of entropy on dielectric medium properties and the heat of reaction is obtained. It is pointed out that the dependence of the transition probability on the heat of the reaction results in a compensation effect. In the limiting case of the exchange integral β being small ($\beta \ll k_B T$) an expression for the activated-complex entropy is derived in agreement with that found in the literature. The validity condition of this approximation is given. Water is chosen as a typical example of a polar medium; the pre-exponent is estimated to be larger by a factor of 10^3 than the one in the Einstein model of a medium vibronic spectrum. The activation energy of the charge transfer is shown to be less than Marcus'. (16 refs.)

120597 New I_2 emission from iodine atom recombination reaction. K.-H.Stephan-Rossbach, F.J.Comes (Inst. fur Phys. und Theoretische Chem., Frankfurt/Main, Germany).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.121-8 (Oct. 1983).
In the UV photolysis of perfluorinated alkyl iodides, iodine atoms in the two spin states $^2P_{1/2}$ and $^2P_{3/2}$ of the electronic ground state are formed. The atoms recombine in a three-body collision to form iodine molecules. The reactive collision of $I(^2P_{3/2})$ with $I(^2P_{1/2})$ leads to $I_2(B)$ which is detected by its chemiluminescence spectrum. The observed spectra contain an additional emission which is discussed to be the result of a transition from a higher excited I_2 state correlating with two $I(^2P_{1/2})$. (26 refs.)

120598 Comment on 'scaling relationships in photoelectron-photoion coincidence studies: the acetone dissociation'. D.J.McAdoo (Marine Biomedical Inst., Univ. of Texas Medical Branch, Galveston, TX, USA).
Chem. Phys. (Netherlands), vol.80, no.1-2, p.203 (Oct. 1983).
Johnson et al. (see ibid., vol.63, p.1, 1981) recently contradicted the conclusion of earlier workers that the acetone ion formed by rearrangement from its enol isomer decomposes without prior equilibration of its internal energy. Johnson et al. proposed that some of the enol ions decomposed to $CH_2=C=OH^+$ rather than $CH_3C\equiv O^+$ to explain inflection points in the kinetic energy release distributions (KERDs). The author comments on this rearrangement. (8 refs.)

120599 Determination of rate constants for some reactions of CBr radicals by VUV laser flash photolysis. L.Hellner, K.T.V.Grattan, M.H.R.Hutchinson (Blackett Lab., Imperial Coll., London, England).
Chem. Phys. (Netherlands), vol.80, no.3, p.345-50 (15 Oct. 1983).
The CBr radical has been produced by VUV laser flash photolysis of $CHBr_3$ and absolute rate constants for reactions with O_2, CO_2 and N_2 have been measured. The possible mechanisms of these reactions have been discussed. (20 refs.)

120600 Reaction rates of D_2+T_2 mixtures at 295K. G.T.McConville, D.A.Menke, R.E.Ellefson (Monsanto Res. Corp., Miamisburg, OH, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1441-6 (1983).
Reaction rates for the production of DT from D_2+T_2 mixtures are reported as a function of pressure, initial T_2 concentration, and concentration of the impurity of CT_4. The reactions took place in a specially constructed stainless steel container. The reactions are reproducible and can be explained in terms of the ion-molecule chain model of Thompson and Schaeffer (1958). The presence of T_2O as an impurity has no measurable effect at the measured concentration. (16 refs.)

120601 Thermal stability of molybdenum diiodide. L.A.Klinkova (Inst. of Solid-State Phys., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1631-4 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1896-9 (Nov. 1982).
It was shown that molybdenum diiodide does not disproportionate with formation of higher iodides when heated in a vacuum, as is the case with other molybdenum halides. Solid molybdenum diiodide becomes depleted in iodine within the limits of the homogeneity range of $MoI_{2-x}(x \leq 0.08)$ when heated to 1000K in a static vacuum, and dissociated into molybdenum above 1000K. Molybdenum begins to evaporate in a static vacuum above 870K and is stable in the gaseous form in the Mo-I system up to 1080K; the gaseous iodide subsequently begins to dissociate into molybdenum. In as atmosphere of iodine, solid MoI_2 is stable up to 1270K, with gaseous MoI_2 is stable up to 1370K. (8 refs.)

120602 Thermal stability of molybdenum triiodide. L.A.Klinkova (Inst. of Solid-State Phys., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1635-9 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1900-3 (Nov. 1982).
It was found that the composition of molybdenum triiodide corresponds to $MoI_{3-2.88}$ upon heating to 691K in a vacuum; above 691K, MoI_3 decomposes into molybdenum diiodide. In an atmosphere of iodine, the solid triiodide is stable up to higher temperatures. (6 refs.)

120603 Mass-spectrometric study of the behavior of molybdenum di- and triiodide during heating to 743K. L.A.Klinkova, G.G.Sikharulidze, A.E.Lezhnev (Inst. of Solid-State Phys., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1647-8 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1911-13 (Nov. 1982).
The composition of the products of molybdenum di- and triiodide decomposition upon heating to 743K has been studied by mass-spectroscopy. (5 refs.)

120604 Structure and reactivity of gas-phase ions: $C_4H_4^{+\cdot}$. W.Wagner-Redeker, A.J.Illies, P.R.Kemper, M.T.Bowers (Dept. of Chem., Univ. of California, Santa Barbara, CA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5719-24 (7 Sept. 1983).
The structure and reactivity of $C_4H_4^{+\cdot}$ ions in the gas phase have been investigated with use of collision-induced dissociation (CID) and tandem ion cyclotron resonance spectroscopy. Two stable isomers were identified, one linear $C_4H_4^{+\cdot}$ and one cyclic $C_4H_4^{+\cdot}$, in agreement with observations of Ausloos (1981). The m/z 26/27 ratio in the CID pattern of $C_4H_4^{+\cdot}$ is strongly dependent on the isomeric content of the $C_4H_4^{+\cdot}$ beam. This ratio was calibrated against isomeric composition, and the percent cyclic and linear $C_4H_4^{+\cdot}$ arising from a variety of sources was explored. The ion chemistry of $C_4H_4^{+\cdot}$ with C_2H_2 was examined in the tandem ICR. The linear form reacted with a rate constant of $\sim(3\pm1.5)\times10^{-10}$ cm^3/s, while the cyclic form reacted extremely slowly if at all. Acetylene 'catalyzes' isomerization of linear $C_4H_4^{+\cdot}$ to cyclic $C_4H_4^{+\cdot}$ with a rate constant of $\sim1\times10^{-10}$ cm^3/s, presumably via a long-lived $C_6H_6^{+\cdot}$ intermediate. (28 refs.)

120605 Syntheses and structures of the $[Fe^{III}(SPh)_4]^-$ and $[Fe^{III}(SEt)_4]^-$ anions. A general route to iron(III) tetrathiolate complexes. S.A.Koch, L.E.Maelia (Dept of Chem., State Univ. of New York, Stony Brook, NY, USA).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5944-5 (7 Sept. 1983).
The authors' recent success using the sterically hindered thiolate ligand 2,3,5,6-tetramethylbenzenethiolate to stabilize the $[Fe^{III}(Sr)_4]$ coordination unit has prompted them to reexamine the problem of $[Fe^{III}(SR)_4]^-$ complexes with less sterically hindered ligands. They report a new and general route to the synthesis of stable iron(III) tetrathiolate complexes. (16 refs.)

120606 Selective effects of homogeneous and heterogeneous reactions in the system N_2*-CO. O.Dessaux, P.Goudmand, B.Mutel (Lab. de Spectroscopie de la Reactivite Chimique, Univ. des Sci. et Tech. de Lille, Villeneuve D'Ascq, France).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.4, p.311-16 (Oct. 1983).
In the system N_2*-CO, effects arising only from the reactions in the homogeneous phase have been isolated in a reactor with inert walls. After an induction period of 0.13 s, they involve a stationary rate of enhancement of $N_2(B^3\Pi_g)$ and $N(^4S)$ concentrations according to the reactions $N_2(X^1\Sigma_g^+)_{v*}+CO\to CO(X^1\Sigma^+)_{v*}+N_2(X^1\Sigma_g^+)$ and $CO(X^1\Sigma^+)_{v*}+N_2(A^3\Sigma_u^+)\to N(^4S)+N(^4S)+CO(X^1\Sigma^+)$. In a reactor with active walls, both the above reactions in the homogeneous phase and heterogeneous reactions due to CO adsorbed on the walls are involved according to $CO_{ads}+N_2(X^1\Sigma_g^+)_{v*ads\ or\ not}\to CO(X^1\Sigma^+)_{v*}+N_2(X^1\Sigma_g^+)$ and $N(^4S)+N(^4S)+CO_{ads}\to N_2(X^1\Sigma_g^+)+CO(X^1\Sigma^+)N(^4S)+CO_{ads}\to N_2(X^1\Sigma_g^+)$-$+CO(X^1\Sigma^+)$. In this case, the rate of enhancement is not stationary. Furthermore, for cylindrical reactors with large diameters, the two types of reaction do not interact and their effects are additive. (7 refs.)

120607 Gas-phase equilibria of isotopic lithium systems. I. Pure lithium. Y.C.Chan, W.C.Stwalley (Depts. of Chem. & Phys., Univ. of Iowa, Iowa City, IA, USA).
J. Chem. Thermodyn. (GB), vol.15, no.10, p.989-93 (Oct. 1983).
The thermodynamic properties of the diatomic lithium molecules $^6Li_2$, $^6Li^7Li$, and $^7Li_2$ are calculated from the latest spectroscopic quantities. In addition, equilibrium constants for formation of these lithium molecules from their atoms are computed for temperatures to 2000K. (16 refs.)

120608 Gas-phase equilibria of isotopic lithium systems. II. Lithium and hydrogen. Y.C.Chan, W.C.Stwalley (Depts. of Chem. & Phys., Univ. of Iowa, Iowa City, IA, USA).
J. Chem. Thermodyn. (GB), vol.15, no.10, p.995-1000 (Oct. 1983).
For pt.I see ibid., vol.15, p.989 (1983). Gas-phase equilibria of the isotopic lithium and hydrogen systems are considered here. In addition to calculation of the equilibrium constants, the thermodynamic functions for the isotopic lithium hydride molecules ($^6Li^1H$, $^6Li^2H$, $^6Li^3H$, $^7Li^1H$, $^7Li^2H$, and $^7Li^3H$) are computed for temperatures to 2000K. (10 refs.)

120609 Structural study of the cis-to-trans thermal isomerization in polyacetylene. P.Robin (Lab. Central de Recherches, Thomson-CSF, Orsay, France), J.P.Pouget, R.Comes, H.W.Gibson, A.J.Epstein.
J. Phys. Colloq. (France), vol.44, no.C-3, p.77-81 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
An X-ray study of the cis to trans thermal isomerization in polyacetylene is given. It shows that the isomerization process is homogeneous without clustering of trans regions within the cis host lattice. (14 refs.)

120610 Models for the kinetics of cis-trans isomerization in polyacetylenes. O.Parodi (Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.119-22 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Two models are proposed for thermal isomerization. The first one is a growth model with random nucleation. The second one is a pure random model. This second model is the only one to account for the differences in characteristic times obtained from different experimental techniques. (6 refs.)

120611 Cis-trans isomerization of polyacetylene. H.W.Gibson, R.J.Weagley, W.M.Prest,Jr., R.Mosher, S.Kaplan (Webster Res. Center, Xerox Corp., Webster, NY, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.123-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The isomerization of polyacetylene from the cis to the trans form has been monitored by Fourier transform infrared spectroscopy (FTIR) and by magic angle ^{13}C nuclear magnetic resonance spectroscopy (NMR). The importance of using thin films (<10 μm) for determination of the isomeric composition with grating IR instruments is emphasized. A method utilizing integrated intensities (areas) of the IR peaks at 740 and 1013 cm^{-1} was developed. NMR data was found to correlate with the FTIR data. The kinetics are not simple. In order to obtain activation energies the correct kinetic equations must be used; such equations will be described elsewhere. Trans units are generated randomly in the cis matrix (NMR evidence). The presence of significant ($\sim$7%) residual cis content even at extended times and temperatures (FTIR evidence) is observed. These facts indicate an average trans sequence length of 15 double bonds or less. (8 refs.)

120612 Stability of iodine-doped polyacetylene in aqueous environments. A.Guiseppi-Elie, G.E.Wnek (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.193-7 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Iodine-doped polyacetylene has been found to display exceptional stability in deaerated, aqueous environments and to degrade in the presence of aqueous nucleophiles with a rate which increases with increasing nucleophilicity. (11 refs.)

120613 Thermal decomposition of iodine doped polyacetylene. S.Pekker, G.Mihaly (Central Res. Inst. for Phys., Budapest, Hungary).
J. Phys. Colloq. (France), vol.44, no.C-3, p.203-5 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Thermogravimetric studies of iodine doped polyacetylene are presented. The weight loss is strongly dependent on the heating rate: at 5°C/min the decomposition is continuous while at 30°C/min an explosion can be observed at the melting point of iodine. The explosion can be explained as a result of exothermic reaction between polyacetylene and liquid iodine. (3 refs.)

120614 EPR and IR investigation on cis-trans isomerization and oxidation of polyacetylene films. A.Zanobi, L.D'Ilario (Assoreni, Rome, Italy).
J. Phys. Colloq. (France), vol.44, no.C-3, p.309-11 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The mechanism of polyacetylene cis-trans isomerization has been investigated. The authors present evidence that the isomerization takes place through the cleavage of a double bond with radical formation and that oxygen catalyses this reaction. (6 refs.)

120615 New synthetic approaches to tetrathiafulvalene derivatives: systematic modifications of BEDT-TTF and TMTTF donors. R.R.Schumaker, V.Y.Lee, E.M.Engler (IBM Res. Lab., San Jose, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1139-45 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
A new synthetic procedure for preparing a variety of substituted tetrathiafulvalene (TTF) derivatives is described which involve a double cyclization reaction to construct the TTF skeleton from the inside out. This method provides a convenient synthesis of per-deuterated tetramethyl-TTF. A variety of chemically modified derivatives of bis(ethylenedithio)-TTF (BEDT-TTF) have been elaborated, including the new donors: bis(ethylenediseleno)-tetraselenafulvalene (BEDSe-TSeF), bis(ethylenedithio)-tetraselenafulvalene (BEDT-TSeF), bis(vinylenedithio)-tetrathiafulvalene (BVDT-TTF), bis(dimethylvinylenedithio)-tetrathiafulvalene (BDVDT-TTF) and bis(2-thiapropylenedithio)-tetrathiafulvalene (BTDPT-TTF). (13 refs.)

120616 BDMT-TXF—a new series of tetrachalcogen fulvalenes. K.A.Lerstrup, D.O.Cowan (Johns Hopkins Univ., Baltimore, MD, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1247-8 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Three new fulvalene donors, bidimethylthiopheno-tetrathiafulvalene, -tetraselenafulvalene, and -tetratellurafulvalene were prepared from 3,4-dibromo-2,5-dimethylthiophene. (4 refs.)

120617 Redox polymeric film formation by oxidation of dibenzo-crown ethers. V.Le Berre, R.Carlier, J.Simonet, A.Tallec (Lab. d'Electrochimie, Univ. de Rennes I, Rennes, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.1269-72 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
New 2-dimensional conducting polymers have been synthetized by anodic oxidation of dibenzo-crown ethers. (2 refs.)

120618 Chlorination of natural rubber vulcanizates in chlorine solutions in halogenated hydrocarbons. J.Perkowski, J.S.Miller (Politech. Lodzka, Lodz, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.4, p.129-31 (April 1983). In Polish. [received: Oct. 1983]
It has been shown that the exposure of rubber to the action of Cl_2-solution in carbon tetrachloride causes a decrease in the coefficient of friction without negatively affecting the mechanical properties of rubber. The optimum reaction conditions have been established; they are: duration 10-20 s; Cl_2-concentration in CCl_4-0.06-0.12 wt.%; temperature 293K. A flowsheet of the plant has been presented and guidelines for the design of the chlorination process for the windscreen wipers by this method have been presented. (5 refs.)

120619 Cyclization dynamics of polymers. IX. The effect of polymer concentration on the slowest internal relaxation mode of a labelled polystyrene chain. A.E.C.Redpath, M.A.Winnik (Dept. of Chem., Univ. of Toronto, Toronto, Ontario, Canada).
Polymer (GB), vol.24, no.10, p.1286-90 (Oct. 1983).
A combination of steady-state and fluorescence decay techniques permits one to measure the dynamics of end-to-end cyclization of a polymer chain substituted at both ends with pyrene groups. In the limit of low concentration, the rate constant for cyclization, k_{cy}, can be identified with the slowest relaxation rate τ_1^{-1} of a Rouse-Zimm chain. Experiments are reported which allow k_{cy} to be examined for two chain lengths of polystyrene substituted on both ends with pyrene groups. These chains have $M_n=9200$ and 25000 ($M_w/M_n\leq1.15$). Added unlabelled polystyrene polymer [PS] causes k_{cy} to decrease in cyclohexane just above the θ-temperature, whereas in toluene, a good solvent, k_{cy} is largely unaffected, even at [PS] concentrations of 50 wt.%. These results are explained in terms of frictional effects-hydrodynamic screening—dominating in the poor solvent, whereas other factors tend to have offsetting effects in the good solvent. (28 refs.)

120620 Selective solvation of polystyrene in tetralin/cyclohexane mixtures. A.Abdel-Azim.Abdel-Azim, M.B.Huglin (Dept. of Chem. & Appl. Chem., Univ. of Salford, Salford, England).
Polymer (GB), vol.24, no.10, p.1308-12 (Oct. 1983).
Refractive index increments and density increments have been measured at 307.6K for polystyrene in binary solvents of 1,2,3,4-tetrahydronaphthalene (tetralin, TET) and cyclohexane over the whole range of solvent composition. Comparison of these increments with the corresponding values obtained at dialysis equilibrium (i.e. at constant chemical potential of low molecular weight species) yielded the coefficients of selective adsorption (γ_1) of TET by the polymer. Positive values of γ_1 were exhibited at solvent compositions up to 78% (v/v) of the thermodynamically better solvent, TET. Theoretical curves of γ_1 vs. composition were calculated on the basis of, firstly, relevant interaction parameters and, secondly, interaction parameters in conjunction with solubility parameters. Both procedures afforded self-consistent results, which were, however, uniformly lower than the experimental values of γ_1. (40 refs.)

120621 Ultrasonic detection of free radicals decay in polyethyl methacrylate. M.Mongy, A.W.Aziz, M.El-Sabee (Nat. Inst. for Standards, Cairo, Egypt).
Radiat. Phys. & Chem. (GB), vol.19, no.2, p.147-50 (1982). [received: Oct. 1983]
Free radical formation and decay in PEMA has been detected by ultrasonic technique. The results obtained, though somewhat different from earlier data, yet they support the idea that the ultrasonic measurement is a sensitive method for detecting the formation and decay of free radical in polymers. (9 refs.)

120622 Le Chatelier principles of stable chemical equilibrium. II. Reactions in ideal gaseous phase. F.C. Olivera (Univ. Simon Bolivar, Caracas, Venezuela).
Scientia (Chile), vol.46, no.156-157, p.41-9 (Jan.-Dec. 1981). In Spanish. [received: Sept. 1983]
Equations previously derived for the stable equilibrium of chemically reactive systems are applied to the simple case of ideal mixtures of perfect gases. It is shown that the addition of a small amount of any component changes the equilibrium state so as to decrease the mole fraction of the same component. Depending on the initial composition, this behaviour may for some reactions result in an actual decrease in the equilibrium conversion when a reactant is added to, or a product is removed from, the reacting mixture. (8 refs.)

120623 Synergistic effects for the $TiO_2/RuO_2/Pt$ photodissociation of water. G.Blondeel, A.Harriman, D.Williams (Davy Faraday Res. Lab., Royal Inst. London, London, England).
Sol. Energy Mater. (Netherlands), vol.9, no.2, p.217-27 (July-Sept. 1983).
Compressed discs of naked TiO_2 or TiO_2 coated with a thin film of a noble metal (e.g. Pt) do not photodissociate water upon illumination with UV light but small amounts of H_2 are generated if the TiO_2 has been reduced in a stream of H_2 at 600°C. Discs prepared form mixtures of TiO_2/RuO_2 facilitate the UV photodissociation of water into H_2 and O_2 although the yields are very low. When a thin (ca. 9 nm) film of Pt is applied to the TiO_2/RuO_2 discs the yields of H_2 and O_2 observed upon irradiation with UV light are improved drastically. In this paper, the authors attempted to verify that both RuO_2 and Pt are mandatory for efficient photodissociation of water with n-type TiO_2 and, without extensive analytical evaluation of particulate material, the only way that this can be shown is by the use of macroelectrodes. (25 refs.)

120624 Location of transition states and stable intermediates by MINIMAX/MINIMI optimization of synchronous transit pathways. A.Jensen (Inst. fur Organische Chem., Johannes Gutenberg-Univ., Mainz, Germany).
Theor. Chim. Acta (Germany), vol.63, no.4, p.269-90 (1983).
The MINIMAX/MINIMI concept of the location of transition states and/or stable intermediates of chemical reactions is introduced, based on the synchronous transit method. According to this strategy, minimization of quadratic synchronous transit path maxima or minima is achieved by constrained exhaustive optimization of internal coordinates. The method and its efficiency are demonstrated for two-dimensional model surfaces as well as for thermally allowed electrocyclic interconversions of cyclopropyl-/allyl-cation and cyclobutene-/butadiene (gauche) within the framework of MNDO-SCF calculations. Thus, in both cases a direct comparison with the exact solution determined by minimization of the scalar gradient norm and cross reference to the original work of Halgren and Lipscomb 1977 is possible. (21 refs.)

120625 Chemical applications of topology and group theory. XIV. Topological aspects of chaotic chemical reactions. R.B.King (Dept. of Chem., Univ. of Georgia, Athens, GA, USA).
Theor. Chim. Acta (Germany), vol.63, no.4, p.323-38 (1983).
For pt.XIII see ibid., vol.63, p.103-32 (1983). Earlier approaches to the analysis of chemical dynamic systems using kinetic logic are defined to deal more effectively with systems having the two or more feedback circuits required for chaos. The essential kinetic features of such system can be represented by a directed graph (called an influence diagram) in which the vertices represent the internal species and the directed edges represent kinetic relationships between the internal species. Influence diagrams characteristic of chaotic chemical systems have the following additional features: (1) they are connected; (2) each vertex has at least one edge directed towards it and one edge directed away from it; (3) there is at least one vertex, called a turbulent vertex, with at least two edges directed towards it. (33 refs.)

120626 Radiochemical investigation of the gas-phase interaction of free butyl cations with benzene under enhanced pressure. V.D.Nefedov, E.N.Sinotova, Yu.M.Arkhipov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.109-12 (Aug. 1983). In Russian.
Sec-butylbenzene is the main product of the gas-phase butylation of benzene by free *n*-butyl cations in the pressure range 90-310 kPa. *N*-butyl cation isomerization is estimated to take place in less than 10^{-10} s. (3 refs.)

MINDO/3 study of the hydrogen insertions of cyclopropenylidene and cyclopropylidene .... See Entry 117780

Theoretical determination of fine-structure transitions occurring in collisional redistribution of light .... See Entry 117825

HCl vibrational distribution in the dissociation of vinyl chloride activated by flash photolysis of 3-chloro-3-methyldiazirine .... See Entry 117852

NMR spectra of porphyrins. XXI. Applications of the ring-current model to porphyrin and chlorophyll aggregation .... See Entry 117889

Laser-induced fluorescence detection of OH produced by reaction of hot H atoms with CO_2 .... See Entry 117902

Generation of $^1O_2$ from O_2 quenching of the lowest excited singlet and triplet states of 9,10-diphenylanthracene .... See Entry 117908

Vacuum ultraviolet photoelectron spectroscopy of transient species. XVI. The $NCO(X^2\Pi)$ radical .... See Entry 117926

First observation of the Thomas peak in continuum capture: capture of H atoms from CH_4 molecules by fast Ar^+ projectiles .... See Entry 117963

Evidence of dynamical effect on molecular autoionization from He^+ impact on He .... See Entry 117977

Charge transfer between neon ions and metastable helium .... See Entry 117982

Electron impact excitation of λ7990-Å multiplet .... See Entry 117996

Cross-links in polyacetylene .... See Entry 118021

Conformational and functional properties of haemoglobin in water+alcohol mixtures. Dependence of bulk electrostatic and hydrophobic interactions upon pH and KCl concentration .... See Entry 118849

X-ray diffraction studies of iodine doped polyacetylene .... See Entry 118909

An X-ray investigation on cis-trans polyacetylenes .... See Entry 118910

Crystallization of TCNQ salts from acetonitrile in the presence of association equilibria .... See Entry 118930

Thermostimulated creep study of undoped polyacetylene $(CH)_x$ films .... See Entry 119099

Thermal properties of doped and undoped $(CH)_x$ .... See Entry 119286

Auger spectroscopy of metal-semiconductor interface in the $In-Pb_{1-x}Sn_xTe$ system .... See Entry 119354

Polyacetylene: the search for solitons .... See Entry 119554

Liquid crystalline organic conductors .... See Entry 119570

Photocondutivity of polyacetylene .... See Entry 119653

NMR investigations of native and doped polyacetylene films .... See Entry 119937

Structural aspects of polyacetylene from resonance Raman scattering .... See Entry 120056

Raman study of doped polyacetylenes .... See Entry 120062

Substitution reactions in solvent-ferrite systems and acid-base properties of the components .... See Entry 120238

Importance of chain reactions in the plasma deposition of hydrogenated amorphous silicon .... See Entry 120264

Magnetic field effect on the hydrogen abstraction of xanthone from xanthene in SDS micelles .... See Entry 120664

Equilibrium decomposition pressures of the compounds Cs_2ZrCl_6 and Cs_2HfCl_6 and X-ray identification of Na_2HfCl_6, K_2HfCl_6, and Cs_2HfCl_6 .... See Entry 120666

A morphological description of the secondary structure of disperse carbon, synthesized by a polycondensation method .... See Entry 120680

Energy storage using the BaO_2-BaO reaction cycle .... See Entry 120770

82.35 POLYMER REACTIONS AND POLYMERIZATION

120627 Polymerization of acetylene with new catalysts, new doping agents, morphology and electrical conductivity of the doped polyacetylene films. F.Schue, M.Aldissi (Lab. de Chimie Macromoleculaire, Univ. des Sci. et Tech. du Languedoc, Montpellier, France), J.C.Dubois, L.Giral, M.Roland, J.Sledz.
J. Phys. Colloq. (France), vol.44, no.C-3, p.17-19 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The catalytic activities of WCl_6-Ph_4Sn, $MoCl_5-Ph_4Sn$ and tetrabenzyltitanium were examined in the polymerization of acetylene. (9 refs.)

120628 Insertion of $FeCl_4^-$, $AlCl_4^-$ and HSO_4^- ions into polyacetylene—study of the reaction conditions and properties of the products. J.Przyluski (Dept. of Chem., Tech. Univ. of Warsaw, Warsaw, Poland), D.Billaud, M.Zagorska, C.Budrowski, A.Pron.
J. Phys. Colloq. (France), vol.44, no.C-3, p.29-32 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The electrochemical intercalation of $FeCl_4^-$ and AlC_4^- ions into polyacetylene is reported. After exposure to air, polyacetylene tetrachloroferrates are much more stable than polyacetylene tetrachloroaluminates. The chemical intercalation of HSO_4^- into polyacetylene from H_2SO_4 vapours is described. The action of water on the polyacetylene hydrogen sulfates formed is discussed. (5 refs.)

120629 Synthesis of graft and block copolymers containing $(CH)_x$ segments. G.F.Dandreaux, M.E.Galvin, G.E.Wnek (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.135-8 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Two approaches have been investigated to expand the scope of polyacetylene derivatives, namely (1) the use of doped $(CH)_x$ as a macromolecular initiator for the synthesis of graft copolymers, and (2) transformation reactions as a route of block copolymer syntheses. (9 refs.)

120630 A new 'processable' polyacetylene modification. J.Hocker, G.Schneider (Zentrale Forschung und Entwicklung, Bayer AG, Leverkusen, Germany).
J. Phys. Colloq. (France), vol.44, no.C-3, p.147-9 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Using a special catalyst on the Ziegler-Natta basis and special reaction conditions it is possible to polymerize acetylene for obtaining a new polyacetylene modification with burr- or fibre-shaped particles which can be processed to foils, non-wovens and coatings. (4 refs.)

120631 Molecular weight and kinetics of acetylene polymerization. M.A.Schen, J.C.W.Chien, F.E.Karasz (Dept. of Polymer Sci. & Engng., Univ. of Massachusetts, Amherst, MA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.163-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The molecular weight of polyacetylene initiated by $Ti(OBu)_4/4N(Et)_3$ catalyst was studied by radioquenching using CH_3O^3H. The effects of Al/Ti ratio, catalyst ageing, catalyst concentration, polymerization temperature, and monomer pressure on the polymerization were investigated. Concurrently, studies using ^{14}CO as the radioquenching agent to count the number of active

sites (C) and CH_3O^3H to determine the total metal polymer bonds (MPB) have defined the kinetics. The authors' interpretation of the results lead to the postulation that the active species C_1 is initially extremely reactive and that within 30 minutes are all converted, through bimolecular kinetics, to a much less active species C_2. (6 refs.)

120632 Semiconductor properties of the anodic polymer obtained on platinum from selenocyanate ammoniate. M.Bragadin, G.Scarponi, F.Ossola (Univ. Venezia, Venezia, Italy), F.Pucciarelli, M.G.Bettoli.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1357-9 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
Evidence is given that the deposit obtained from anodic oxidation of selenocyanates is a polymer with a semiconductor-like behaviour. (9 refs.)

120633 Synthesis of cast urethane elastomers for the formation of gaskets on stoneware pipes by the method of casting. E.Halasa (Politech. Rzeszowska im. I. Lukasiewicza, Rzeszow, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.4, p.126-9 (April 1983). In Polish. [received: Oct. 1983]
The effect of some selected Rokopol-type polyetherols and catalysts on the time of gelation, time to dust dryness, mechanical properties and resistance of cast urethane elastomers (LEU) to the action of dilute acids and alkalis has been investigated. The best raw material for the preparation of LEU is Rokopol M12, a block copolymer of propylene oxide and ethylene oxide reacted with glycerol, with $M_n = 4700$. (3 refs.)

Synthesis and properties of $(CH)_x$-films prepared by polymerization of BTFM-TCDT ....See Entry 118911

A new form of polyacetylene ....See Entry 118912

Anionic polymerization of isoprene by the complexes oligoisoprenyllithium/tertiary polyamines in cyclohexane. III. Structural study of the polymers by ^1H NMR at 100 MHz ....See Entry 118918

Structure and morphology of segmented polyurethanes. II. Influence of reactant incompatibility ....See Entry 118920

Structure of dense cross-linked polymers of dimethacrylates and oligo-*n*-methacrylates ....See Entry 118921

Effect of copolymerization on the glass transition temperature of PAN ....See Entry 119196

Formation of highly conducting derivatives of polyacetylene through oxidation with selected metal halides ....See Entry 120298

Structural study of the cis-to-trans thermal isomerization in polyacetylene ....See Entry 120609

Thermal decomposition of iodine doped polyacetylene ....See Entry 120613

EPR and IR investigation on cis-trans isomerization and oxidation of polyacetylene films ....See Entry 120614

Study of relaxation in cross-linked polymer compositions ....See Entry 120659

Study of the porous structure and selective properties of membranes obtained by plasma polymerization in a glow discharge ....See Entry 120671

82.40 CHEMICAL KINETICS AND REACTIONS: SPECIAL REGIMES

120634 Effect of oxidation on the calorific value and spontaneous ignition of stored coal. V.Dusak.
Energetika (Czechoslovakia), vol.33, no.8, p.386-91 (Aug. 1983). In Czech.
Losses caused by oxidation of coal in dumps cannot be replaced nor reliably computed at the present time. Deterioration of coal takes place when oxygen is absorbed from the air and result in subsequent oxidation of the coal. Oxidation begins from the time the coal is disintegrated from the seam, when it is most intensive, and continues up to consumption of the coal. Oxidation is speeded up by a number of factors, such as temperature; as it increases the amount of oxygen also increases. Oxidation causes diminishing of the value of combustion heat and heat content of the coal. Lowering of these values corresponds to the smaller content of carbon and hydrogen. (42 refs.)

Electron impact excitation of λ7990-Å multiplet ....See Entry 117996

Thermal decomposition of iodine doped polyacetylene ....See Entry 120613

Improved laser technique for high sensitivity atomic absorption spectroscopy in flames ....See Entry 120699

Atmospheric sodium chemistry and diurnal variations: an up-date ....See Entry 121414

Photodissociation effects of solar UV radiation ....See Entry 121421

82.40T Chemiluminescence and chemical laser kinetics

(see also 42.55K Chemical lasers, 78.60P Chemiluminescence)

Vibrational effects with excitation transfer in metastable rare-gas-halide collisions ....See Entry 117968

New I_2 emission from iodine atom recombination reaction ....See Entry 120597

Optimization of response of chemiluminescence analyzers ....See Entry 120685

82.45 ELECTROCHEMISTRY AND ELECTROPHORESIS

(see also 66.10 Ionic conduction in liquids; for electro-osmosis, see 82.65)

120635 The photoactivity of porous TiO_2 anodized at a high voltage. D.Miller, S.Mamiche-Afara, M.J.Dignam, M.Moskovits (Dept. of Chem., Univ. of Toronto, Toronto, Ontario, Canada).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.236-40 (9 Sept. 1983).
The photoactivity of TiO_2 produced by high-voltage anodization as described by Marchenoir et al. (1980) was compared to single-crystal TiO_2. The anodic oxide film was found to be highly porous. The photocurrent and quantum yield of the anodic sample is markedly larger on the long-wavelength side of the action spectrum as compared to single-crystal rutile. The authors ascribe this behavior either to the formation of anatase 'pockets' in the film or to the incomplete oxidation of Ti during the anodization process. (35 refs.)

120636 Influence of diffusion of electrophoretic deposition in a uniform electric field. V.A.Malov (Lensovet Leningrad Technol. Inst., Leningrad, USSR).
Colloid J. USSR (USA), vol.44, no.6, p.941-4 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1069-72 (Nov.-Dec. 1982). [received: Sept. 1983]
An equation for calculating the weight of an electrophoretic deposit with consideration of the thermal motion of the particles has been obtained. The diffusion flows of the particles accompanying electrophoretic deposition in a uniform electric field influence the laws of deposition when $v^2t/4D \lesssim 5$, where v is the electrophoresis rate, D is the diffusion coefficient of the particles, and t is the time of action of the field. (8 refs.)

120637 Electrolytic oxidation of cerium: improvements in the technology and the uses and applications of such a process. J.-Y.Dumousseau, J.Grosbois, J.Helgorsky (Centre de Recherches, Rhone-Poulenc Recherches, Aubervilliers, France).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.675-6 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
Summary form only given. Numerous oxidizers such as O_3, H_2O_2, Cr^{6+} and MnO_2 are used in organic oxidation reactions. Cerium (IV) is rarely used despite its wide range of redox potentials (from 1.44 V with respect to the normal hydrogen electrode (NHE) in sulphate media to 1.82 V (NHE) in perchlorate media). However, a number of workers have reported the use of cerium (IV) to oxidize organic compounds, e.g. 1,4-naphthoquinone from naphthalene and benzaldehyde from toluene. All these processes have failed because the cerium (IV) salt cannot be regenerated from the cerium (III) salt after the organic oxidation. Many research groups have investigated the electro-oxidation of cerium, but none of them has been able to develop an industrial process. Therefore an electrolytic cell to solve this problem is being investigated and developed. A filter-press electrolytic cell which is compatible with a nitrate or a sulphate electrolyte is used. Cerium is oxidized in the anolyte and the protons are reduced to hydrogen in the catholyte. The two compartments of the cell are separated by a cationic membrane which allows transfer of the protons from the anolyte to the catholyte to form the current.

120638 Effect of radial diffusion on the polarization at porous flow-through electrodes. B.G.Ateya (Chem. Dept., Univ. of United Arab Emirates, Al-Ain, Abu Dhabi).
J. Appl. Electrochem. (GB), vol.13, no.4, p.417-27 (July 1983).
The effect of radial diffusion on the polarization of porous flow-through electrodes has been investigated with the aid of a mathematical model. The proposed model takes into consideration the rates of mass transfer in the axial direction by convection and in the radial direction by diffusion as well as charge transport in the pore electrolyte and electron transfer kinetics at the electrode-electrolyte interface. Normalization of the variables gave rise to dimensionless groups pertinent to the kinetic, ohmic and radial diffusion effects. These are, respectively, I the reversibility index, Δ the parameter of ohmic effect and ψ the parameter of radial diffusion. The latter ($\psi = 2\ \phi/Sh$) is the ratio of two other dimensionless groups. With this formulation, larger values of ψ correspond to more predominant control of the electrode behaviour by radial diffusion. The same is also true for the parameter of ohmic effect Δ. Solutions have been obtained for two limiting cases: negligible and significant potential drop in the pore electrolyte. In both cases, equations have been derived which give the quantitative (highly non-linear) effect of ψ on the current-polarization relations. In the case of a significant ohmic potential drop in the pore electrolyte, it was found that the controlling parameter is the product $\Delta\psi$. The two variables seem to give a synergistic effect since, at large Δ values, a certain change in ψ has a more pronounced effect on the polarization than the corresponding change at lower Δ values. Qualitative and quantitative tests of some aspects of the model are reported using the electrochemical reduction of copper ions from acid copper sulphate solutions at a packed bed of copper particles. Satisfactory agreement was obtained. (19 refs.)

120639 Effect of flow rate and constant operating current on the behaviour of a recirculating electrochemical reactor system. L.H.Mustoe (Dept. of Chem. Engng., Loughborough Univ. of Technol., Loughborough, England), A.A.Wragg.
J. Appl. Electrochem. (GB), vol.13, no.4, p.507-17 (July 1983).
A theoretical analysis is presented for the current-time, voltage-time and power-time relationship and for the energy requirement and process time for the cathodic extraction of copper in a porous flow-through electrode operated as a batch recirculation system under galvanostatic conditions. The anode reaction considered is O_2 evolution and the secondary cathode reaction is H_2 evolution. The copper extraction is under diffusion control, plug flow is assumed in the reactor and perfect mixing in the reservoir. Comparison is made with the case of operation at the limiting current throughout the process duration. (12 refs.)

120640 Electrogeneration of Mn(III) in an undivided cell. J.H.Wagenknecht, J.P.Coleman, R.C.Hallcher, D.E.McMackins, T.E.Rogers, W.G.Wagner (Corporate Res. Labs., Monsanto Co., St. Louis, MO, USA).
J. Appl. Electrochem. (GB), vol.13, no.4, p.535-40 (July 1983).
The electrochemical oxidation of manganous ion to manganic ion in acetic acid may be efficiently carried out in a parallel plate undivided cell. Reduction of manganic ion to manganous ion at the cathode is a relatively inefficient reaction, allowing the formation of solutions of manganic ion as high as 0.05 mol dm^{-3}, at greater than 80% current efficiency. The effects of the major variables have been evaluated. (36 refs.)

120641 On the microstructure of teflon-bonded platinum-carbon electrodes. R.Holze (Inst. of Phys. Chem., Univ. of Bonn, Bonn, Germany), A.Maas.
J. Appl. Electrochem. (GB), vol.13, no.4, p.549-51 (July 1983).
Proposes a microstructure model for teflon-bonded platinum-carbon gas-diffusion electrodes based on the results of EBMA, SEM and light microscopy. It is confirmed that the microstructure is determined both by direct adherence of agglomerates and teflon-fibrils interconnecting these agglomerates. (12 refs.)

120642 Sensitization of polycrystalline $SrTiO_3$ photoanodes by mechanical polishing. B.T.Chang, G.Campet, J.Claverie, P.Hagenmuller (Univ. de Bordeaux I, Talence, France), J.B.Goodenough.
J. Solid State Chem. (USA), vol.49, no.2, p.247-55 (Sept. 1983).
The photoelectrochemical properties of polycrystalline $SrTiO_3$ anodes have been investigated as a function of surface treatment. Mechanical polishing of the undoped samples results in an anomalous visible photoresponse extending to 6000 nm. The polishing effect can be removed by either chemical etching or annealing of the samples. An energy diagram of the polished undoped $SrTiO_3$ electrode and the main mechanism of its visible photoresponse have been proposed. (52 refs.)

120643 The aqueous and non-aqueous electrochemistry of polyacetylene: application in high power density rechargeable batteries. A.G.MacDiarmid (Dept. of Chem., Univ. of Pennsylvania, Philadelphia, PA, USA), R.B.Kaner, R.J.Mammone, A.J.Heeger.
J. Phys. Colloq. (France), vol.44, no.C-3, p.543-50 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Polyacetylene can be doped either chemically or electrochemically in aqueous solution to the metallic regime. The characteristics of selected rechargeable batteries employing $(CH)_x$ electrodes in non-aqueous electrolytes are described. (2 refs.)

120644 Conductive polymers as electrode materials. M.Armand (Lab. d'Energetique Electrochimique, Domaine Univ., St.-Martin-d'Heres, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.551-7 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
Polyacetylene and its related polymers are amphoteric insertion compounds accommodating both cations and anions. This property make them ideal candidates for electrochemical energy storage. However, the electrochemistry of these compounds is not fully clarified and the main remaining problems are evoked. (22 refs.)

120645 Electrochemical oxidation and reduction of polyparaphenylene. F.Maurice, G.Froyer, Y.Pelous (CNET, LAB/ROC/TIC, Lannion, France).
J. Phys. Colloq. (France), vol.44, no.C-3, p.587-90 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
The authors have studied the electrochemical oxidation and reduction of polyparaphenylene (PPP) synthesized in powder form from benzene. Although initially insulating, the polymer could be oxidized or reduced very easily due to a good porosity of the material. High discharge currents could be obtained, but with a limited coulombic efficiency. The difference between the onset voltages of oxidation and reduction is about 2.8 V. (8 refs.)

120646 Electrochemical solid-state study of organic conducting materials. M.Lamache (Lab. de Chimie Analytique, Univ. Pierre et Marie Curie, Paris, France), A.Moradpour.
J. Phys. Colloq. (France), vol.44, no.C-3, p.1189-93 (June 1983). (Colloque International du CNRS sur la Physique et la Chimie des Metaux Synthetiques et Organiques (International Colloquium of CNRS on the Physics and Chemistry of Synthetic and Organic Metals), Les Arcs, France, 14-18 Dec. 1982).
The anodic oxidation of the following electron donors: TTF, TMTTF, TMTSF, has been studied in the presence of different anions, in order to detect the formation of mixed-valence salts which can be generated during the oxidation of these compounds. Several electrochemical techniques have been used, mainly the carbon paste electrode which allows one to investigate stable intermediate phases which may occur during the redox transformations of organic solids. (11 refs.)

120647 Mass transfer in magnetic fields at vertical electrodes. V.V.Skripachev, Yu.G.Mikhalev, L.A.Isaeva, P.V.Polyakov (M.I. Kalinin Inst. of Nonferrous Metals, Krasnoyarsk, USSR).
Sov. Electrochem. (USA), vol.19, no.1, p.27-32 (Jan. 1983). Translation of: *Elektrokhimiya (USSR),* vol.19, no.1, p.30-5 (Jan. 1983). [received: Sept. 1983]
The method of integral relationships was used to solve the system of differential Navier-Stokes, continuity and convective-diffusion equations for anodic dissolution of a vertical plate in a solution (or melt) which is infinitely dilute with respect to the potential-determining ions and where a homogeneous magnetic field is applied. The solution is written as $Sh=0.75(\beta Sc)^{1/3}Gr^{1/4}$, where β is a parameter that depends on the physicochemical properties of the solution (or melt), the current density, and the magnetic flux density. Results calculated with the equation are in satisfactory agreement with experimental data. (12 refs.)

120648 Discharging and ionization of lead on a germanium electrode. Kh.Z.Brainina, A.V.Kaisin (Sverdlovsk Inst. of the Nat. Economy, Sverdlovsk, USSR).
Sov. Electrochem. (USA), vol.19, no.1, p.78-82 (Jan. 1983). Translation of: *Elektrokhimiya (USSR),* vol.19, no.1, p.87-91 (Jan. 1983). [received: Sept. 1983]
The discharging and ionization of lead on single-crystal germanium electrodes with different types of conduction, as well as the influence of the concentration of lead ions in the solution, the potential for limiting cathodic polarization, and illumination, on the processes just indicated have been investigated by cyclic voltammetry. The results obtained have been attributed to two factors: the presence of the metal in two energy states on the electrode surface and the changes in the kinetics of the electrode process upon illumination of the electrode surface. (17 refs.)

Electrochemical and ESR studies of 5,6:11,12-bis(dichalcogeno) tetracenes and their cation radicals .... See Entry 117898

Mass transfer studies in porous electrodes: application of the limiting current technique .... See Entry 118668

On the coupling between the double layer and the solvent polarization fields .... See Entry 118831

Radical cation salts of arenes, synthesis, structures and properties .... See Entry 118995

Surface chemistry of polyacetylene .... See Entry 119311

New organic conductors in TTF family .... See Entry 119567

ESR study during the electrochemical n-type doping of $(CH)_x$ .... See Entry 119898

An in situ EPR study of electrochemically doped trans polyacetylene .... See Entry 119899

Electrooptical properties of thin films of polyheterocycles ..... See Entry 120025

Effect of electrolysis time on the magnetic properties of fine iron powders .... See Entry 120275

Conditions of formation, structure, and magnetic properties of finely divided iron produced in the presence of ED-20 epoxide oligomer and oleic acid .... See Entry 120276

Insertion of $FeCl_4^-$, $AlCl_4^-$ and HSO_4^- ions into polyacetylene—study of the reaction conditions and properties of the products .... See Entry 120628

Semiconductor properties of the anodic polymer obtained on platinum from selenocyanate ammoniate .... See Entry 120632

An electrochemical evidence of the O_2 photodesorption from n-TiO_2 surface .... See Entry 120675

Decomposition of β-alumina in an oxygen potential gradient .... See Entry 120729

The technology of the Li/BrCl in $SOCl_2$ inorganic battery system: performance and self-discharge characteristics following long-term storage .... See Entry 120731

Electrochemical cells employing polyacetylene and poly(p-phenylene) as active materials .... See Entry 120732

Solid state batteries with conducting polymers .... See Entry 120733

Lightweight, stable, and rechargeable battery and capacitor with activated carbon fiber electrode .... See Entry 120734

$(CH)_x$ as an electrode material: some properties during the electrochemical process .... See Entry 120735

82.50 PHOTOCHEMISTRY AND RADIATION CHEMISTRY

(see also 33.50 Fluorescence, phosphorescence; radiationless transitions)

120649 Infrared emissions in the CO_2-laser-induced photolysis of trifluoromethane-*d* and mixtures of trifluoromethane-*d* and -*h*. Y.Ishikawa, S.Arai (Inst. of Phys. & Chem. Res., Saitama, Japan), H.Yamazaki, Y.Hama.
Appl. Phys. B (Germany), vol.B32, no.2, p.85-92 (Oct. 1983).
Time-resolved infrared emission spectra in the wavelength region of 2-5 μm were measured for the CO_2-laser-induced photolysis of trifluoromethane-*d* (CDF_3) and its mixtures with trifluoromethane-*h* (CHF_3). The reactant pressures were 0.1-20 Torr at room temperature; some collisions were expected to occur within the laser-pulse duration. The emissions due to vibrationally excited CDF_3* (C-D stretching mode and probably combination mode) and DF* were observed at the same time for the irradiation of pure CDF_3. DF* should be produced in the unimolecular decomposition of CDF_3*. The dependences of the DF* emission on the experimental condition are explicable on the assumption that the collisional energy transfer followed by the decomposition of CDF_3 plays an important role in the present IRMPD, besides its direct multiple-photon decomposition. The mixture of CDF_3 and CHF_3 showed the emissions due to HF* and CHF_3* in addition to DF* and CDF_3*. The ratio between the DF* and HF* emission intensities, I_{DF}/I_{HF}, was examined as a function of pressure. The pressure dependences were similar to those of the selectivity determined previously from the concentration changes of CDF_3 and CHF_3. The irradiation of mixtures with a long duration pulse (80 ns fwhm with a 2 μs) resulted in a marked decrease in I_{DF}/I_{HF}. (30 refs.)

120650 Time-of-flight mass spectrometry using multiphoton ionization and IR multiple photon dissociation: decomposition of the triethylamine cation. J.S.Chou, D.Sumida, C.Wittig (Univ. of Southern California, Los Angeles, CA, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.209-13 (9 Sept. 1983).
Low-energy, adiabatic dissociation pathways of molecular ions can be determined unambiguously by combining IR multiple photon dissociation with a laser based time of flight mass spectrometer. In this study, the authors report the sequential dissociation mechanism for the triethylamine cation. (23 refs.)

120651 Metal carbonyl bond strengths: applications of photoacoustic calorimetry. M.Bernstein, J.D.Simon, K.S.Peters (Dept. of Chem., Harvard Univ., Cambridge, MA, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.3, p.241-4 (9 Sept. 1983).
Photoacoustic calorimetry has been used to determine the bond dissociation energy of a single carbonyl from the group VI hexacarbonyls in ethanol and cyclohexane. The determined reaction enthalpies are for the photodissociation of a single CO from $Cr(CO)_6$, $Mo(CO)_6$, and $W(CO)_6$ in ethanol and cyclohexane are found to be 37, 34, and 38 kcal/mole, respectively. (19 refs.)

120652 Multiphoton ionization detection of photodissociation fragments: NO from CH_3ONO, C_2H_5ONO, and C_3H_7ONO. G.Radhakrishnan (Chem. Dept., Univ. of Southern California, Los Angeles, CA, USA), R.C.Estler.
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.403-7 (23 Sept. 1983).
The single photon photodissociation of CH_3ONO, C_2H_5ONO, and C_3H_7ONO has been studied under collision-free conditions using multiphoton ionization to detect the NO fragment. NO rotational excitation from CH_3ONO was very large ($E_{rot}>2100$ cm^{-1}) and non-thermal, while C_2H_5ONO and C_3H_7ONO produced NO which could be characterized by $T_{rot}=350$ and 250K respectively. (46 refs.)

120653 $OH(X^2\Pi)$ state distribution from HNO_3 and H_2O_2 photodissociation at 193 nm. A.Jacobs, K.Kleinermanns, H.Kuge, J.Wolfrum (Max Planck Inst. fur Stromungsforschung, Gottingen, Germany).
J. Chem. Phys. (USA), vol.79, no.6, p.3162-3 (15 Sept. 1983).
The authors describe OH rotational, vibrational, and fine structure state distributions obtained from HNO_3 and H_2O_2 photodissociation at 193 nm under collision-free conditions. (13 refs.)

120654 The kinetics of the photolysis of thin films of tin diodide. M.Green, T.A.Kuku (Dept. of Electrical Engng., Imperial Coll. of Sci. & Technol., London, England).
J. Phys. & Chem. Solids (GB), vol.44, no.10, p.999-1008 (1983).
The kinetics of photolysis of thin films of SnI_2 have been followed using a quartz crystal microbalance technique. The products of photolysis are iodine gas generated at the surface and tin formed within the SnI_2 (which appears as α-Sn even up to ~400K). Rate as a function of extent of reaction, film thickness, light intensity and wavelength, temperature, doping agents and substrate and finally thin film microstructure have been investigated for both high and low temperature polymorphic forms of SnI_2. The extent of photolysis, which always starts by being linear in time, goes via an intermediate regime to being proportional to $t^{1/2}$. The kinetics of photolysis are similar to PbI_2 studied previously [by Halbrecht et al. (1977)] and, as for that case, the photolysis mechanism is consistent with a rate determining anion motion. (13 refs.)

120655 Temperature dependence of the carbon dioxide photoabsorption cross section between 1200 and 1970 Å. B.R.Lewis, J.H.Carver (Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.4, p.297-309 (Oct. 1983).
Photoabsorption cross sections have been measured for carbon dioxide at 0.5 Å intervals between 1200 and 1970 Å. The instrumental resolution was about 0.05 Å and measurements were performed using relatively low pressures at temperatures near 200, 300, and 370K. The room temperature cross sections are found to be in good agreement with previous measurements and a temperature effect is found which is small at the shorter wavelengths, passing through a minimum near 1400 Å. At longer wavelengths the temperature effect increases steadily until at some fixed wavelengths above 1900 A the cross section increases by a factor of about 20 as the temperature is increased from 200 to 370K. This behaviour is of particular significance to calculations

of carbon dioxide photodissociation rates at low altitudes in the Martian atmosphere. (16 refs.)

120656 NO fluorescence during vacuum-ultraviolet photodissociation of $CFCl_2NO$. C.A.F.Johnson (Dept. of Chem., Heriot-Watt Univ., Edinburgh, Scotland).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1355-63 (Sept. 1983).
Gas-phase photodissociation of $CFCl_2NO$ at 147 nm results in the formation of electronically excited NO in the $B\ {}^2\Pi$ state, giving rise to the well known NO β-emission bands. Collisional effects consequent upon the addition of helium lead to the appearance of fluorescence from the $NO(A\ {}^2\Sigma^+)$ state with emission from the $v'=2$ and 3 levels dominating the spectrum. The results are compared with data obtained previously for other nitrosocompounds. (22 refs.)

120657 Photochemistry and sensitized evolution of hydrogen from water using water-soluble cationic porphyrins. Tetrakis(trimethylaminophenyl)porphyrinatozinc and its free base. K.Kalyanasundaram (Inst. de Chimie Phys., Ecole Polytech. Federale, Lausanne, Switzerland).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.9, p.1365-74 (Sept. 1983).
Photophysical properties (fluroescence spectra, lifetimes, triplet-triplet absorption spectra, triplet lifetimes and quantum yields) and redox potentials have been measured for the free-base, Zn^{2+} derivatives of a cationic water-soluble porphyrin, tetrakis(trimethylaminophenyl)porphyrin [TAPP(4+)]; the values are similar to those of tetrakis(sulphonatophenyl)porphyrin, TPPS(4−). The zinc porphyrin ZnTAPP undergoes facile photoredox reactions and also sensitizes H_2 evolution upon visible-light photolysis in 'sacrificial' systems, albeit with a lower efficiency in comparison with tetrakis(4-methylpyridyl)porphyrin, ZnTMPyP. (19 refs.)

120658 Phosphorence and state of chlorophyll in solutions. K.N.Solov'ev, S.S.Dvornikov, V.N.Knyukshto, A.E.Turkova.
J. Appl. Spectrosc. (USA), vol.38, no.1, p.73-9 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.87-95 (Jan. 1983).
The conditions of previous low-temperature experiments were such that only the solvated long-wave form of the pigments, which is usually stabilized at reduced temperature, was investigated. It seemed necessary to investigate the phosphorescence of a less solvated form of chlorophyll, which is formed at low temperatures under special conditions and does not have an absorption spectrum similar to the absorption spectrum of this pigment at room temperature in nonpolar and weakly polar solvents. The authors present the result of such an investigation; the data obtained are compared with the data for the solvated form. (18 refs.)

120659 Study of relaxation in cross-linked polymer compositions. Yu.I.Rumyantseva, V.M.Anisimov, R.G.Zhbankov, O.N.Karpukhin.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1297-300 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.813-18 (Nov. 1982). [received: Sept. 1983]
The authors have studied the relaxation processes in a cross-linked polymer composition based on cellulose acetophthlate and the dimethacrylate ester of ethylene glycol from the kinetic features of the photooxidation of impurity anthracene. (9 refs.)

120660 Pulse radiolysis conductivity measurements in aqueous solutions with nanosecond time resolution. E.Janata (Radiation Lab., Univ. of Notre Dame, Notre Dame, IN, USA).
Radiat. Phys. & Chem. (GB), vol.19, no.1, p.17-21 (1982). [received: Oct. 1983]
A DC-conductivity apparatus is described which allows high precision time resolved conductometric measurements to be made beginning ~7 ns after a fast electron pulse over a pH range from 3 to 11.5. A time resolution of 1.8 ns has been achieved by using a new type of cell made of glassy carbon and improved detection electronics. A rate constant of $k=1.2\times10^{11}\ M^{-1}\ s^{-1}$ has been determined for the neutralization reaction $H^++OH^- \rightarrow H_2O$ at pH=10.64. (21 refs.)

120661 Scavenger competition in the radiolysis of hydrocarbon systems. G.Foldiak (Inst. of Isotopes, Hungarian Acad. of Sci., Budapest, Hungary).
Radiat. Phys. & Chem. (GB), vol.19, no.2, p.167-8 (1982). [received: Oct. 1983]
The radiation chemical reactions of hydrocarbons have previously been studied in the simultaneous presence of two scavengers to determine certain quantitative relationships. To establish whether this procedure is as simple as presumed the author has studied the radiolysis of cyclohexane containing iodine and/or galvinoxyl (Go). (6 refs.)

120662 State correlation diagrams for the photochemical reactions of organometallics. A.Veillard, A.Dedieu (Lab. de Chimie Quantique, Univ. Louis Pasteur, Strasbourg, France).
Theor. Chim. Acta (Germany), vol.63, no.4, p.339-48 (1983).
State correlation diagrams are proposed for a number of photochemical reactions of organometallics. Spin-orbit coupling is found important to understand the reactivity of these organometallics. (35 refs.)

120663 Investigation of some products of photolysis of aqueous solutions of GMP. N.M.Tsyganenko, L.A.Remizova, N.Ya.Dodonova.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.84-7 (Aug. 1983). In Russian.
Dominated formamidopyrimidine ribotide has been identified among the products of vacuum ultraviolet photolysis of 5′G MP besides guanine. The methods of thin layer chromatography, colour reactions, VUV and IR spectroscopy have been used for this purpose. (9 refs.)

Contrasting picosecond photokinetics of Co^{II} and Co^{III} porphyrins verify excited-state predictions .... See Entry 117809

Absorption spectrum of the carbon tetrachloride molecular cation in noble-gas matrices .... See Entry 117881

Generation of ${}^1O_2$ from O_2 quenching of the lowest excited singlet and triplet states of 9,10-diphenylanthracene .... See Entry 117908

Two-frequency two-photon ionization of nascent $PO(X^2\Pi)$ from the collision-free IR photolysis of dimethyl methylphosphonate .... See Entry 117934

Determination of rotational alignment of $N_2{}^+B^2\Sigma_u{}^+$ and $CO^+B^2\Sigma^+$ following photoionization of N_2 and CO .... See Entry 117940

Comparison of photon-stimulated dissociation of gas-phase, solid and chemisorbed water .... See Entry 117942

Radiochemical isolation and radioactivity calibration of radium-228 by liquid-scintillation counting and gamma-ray spectrometry .... See Entry 118001

Photochemical time-domain holography of weak picosecond pulses .... See Entry 118103

Population inversion in thallium by flashlamp-photodissociation of T1I .... See Entry 118121

Use of photoprotolytic reaction for extending the tuning range of the emission wavelength of a 3-methoxybenzanthrone laser .... See Entry 118137

The lifetime of the fluorescent excited state of liquid cyclohexane .... See Entry 120145

New I_2 emission from iodine atom recombination reaction .... See Entry 120597

Determination of rate constants for some reactions of CBr radicals by VUV laser flash photolysis .... See Entry 120599

Synergistic effects for the $TiO_2/RuO_2/Pt$ photodissociation of water .... See Entry 120623

The photoactivity of porous TiO_2 anodized at a high voltage .... See Entry 120635

Sensitization of polycrystalline $SrTiO_3$ photoanodes by mechanical polishing .... See Entry 120642

An electrochemical evidence of the O_2 photodesorption from n-TiO_2 surface .... See Entry 120675

The young Sun and the atmosphere and photochemistry of the early Earth .... See Entry 121376

82.50E Photodissociation, photoionization as studied by luminescence and radiationless transitions

120664 Magnetic field effect on the hydrogen abstraction of xanthone from xanthene in SDS micelles. Y.Tanimoto, M.Takashima, M.Itoh (Faculty of Pharmaceutical Sci., Kanazawa Univ., Kanazawa, Japan).
Chem. Phys. Lett. (Netherlands), vol.100, no.5, p.442-4 (23 Sept. 1983).
The magnetic field effect (<800 G) on the hydrogen abstraction of xanthone from xanthene in SDS aqueous micellar solutions was studied using laser flash photolysis. The rate of triplet-singlet intersystem crossing of the radical pair of xanthone ketyl and 9-xanthenyl formed upon photolysis decreases from $1.4\times10^6\ s^{-1}$ at 0 G to $0.4\times10^6\ s^{-1}$ at 640 G. (11 refs.)

Role of coherence in multiquantum excitation of molecules by IR laser radiation .... See Entry 117944

Photochemistry and sensitized evolution of hydrogen from water using water-soluble cationic porphyrins. Tetrakis(trimethylaminophenyl)porphyrinatozinc and its free base .... See Entry 120657

82.55 RADIOCHEMISTRY

Radiochemical investigation of the gas-phase interaction of free butyl cations with benzene under enhanced pressure .... See Entry 120626

82.60 CHEMICAL THERMODYNAMICS

(see also 05.70 Thermodynamics)

120665 Enthalpies of formation of Ag-Si, Au-Si and Ag-Au-Si liquid alloys at 1423K. S.Hassam, M.Gaune-Escard (Lab. de Dynamique et Thermophys. des Fluides, Univ. de Provence, Marseille, France), J.P.Bros.
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.9, p.785-92 (Sept. 1983).
The enthalpies of formation of silver-silicon, gold-silicon and silver-gold-silicon were determined at 1423K over a large concentration range; a very high temperature calorimeter was used for these investigations. The author's ternary experimental results were represented correctly with a modified Kohler's relation (1960). (29 refs.)

120666 Equilibrium decomposition pressures of the compounds Cs_2ZrCl_6 and Cs_2HfCl_6 and X-ray identification of Na_2HfCl_6, K_2HfCl_6, and Cs_2HfCl_6. G.J.Kipouros, S.N.Flengas (Dept. of Metall. & Materials Sci., Univ. of Toronto, Toronto, Ontario, Canada).
Can. J. Chem. (Canada), vol.61, no.9, p.2183-8 (Sept. 1983).
The chemical equilibria representing the reactions $Cs_2ZrCl_{6(s\ or\ 1)}=2CsCl_{(s\ or\ 1)}+ZrCl_{4(vap,P,T)}$ and $Cs_2HfCl_{6(s\ or\ 1)}=2CsCl_{(s\ or\ 1)}+HfCl_{4(vap,P,T)}$ were investigated by direct vapour pressure measurements and thermodynamic data such as free energies and enthalpies of reaction have been calculated. The X-ray powder patterns of the compounds Na_2HfCl_6, K_2HfCl_6, and Cs_2HfCl_6 and also reported. With reference to the separation of Hf from Zr by a recently developed process based on the selective reactivity of $ZrCl_4$ $HfCl_4$ vapours with alkali chlorides, it is shown that the efficiency of alkali chlorides as separating agents increases in the order $CsCl \rightarrow LiCl \rightarrow NaCl \rightarrow KCl$. (19 refs.)

120667 Dissolution enthalpies of NaI in binary mixtures of water with aliphatic alcohols methylcellosolve at 298.15K. Enthalpic pair interaction coefficients of NaI-nonelectrolyte in water solution. H.Piekarski (Dept. of Phys. Chem., Univ. of Lodz, Poland).
Can. J. Chem. (Canada), vol.61, no.9, p.2203-8 (Sept. 1983).
The enthalpy of solution, ΔH_{sol}, of NaI in methanol+water, ethanol+water, *n*-propanol+water, isopropanol+water, and methoxyethanol+water at all compositions and ΔH_{sol} of NaI in *s*-butanol+water and tert-butanol+water from 0 to 5 mol% alcohol was measured. The NaI-nonelectrolyte pair interaction enthalpies were determined and correlated with the functions describing some properties of the nonelectrolyte. A functional group additivity concept, introduced by Savage and Wood (1977) or non-ionic solutes, was applied to the interactions between NaI and nonelectrolytes. (54 refs.)

120668 Thermochemical regularities among lanthanide and actinide oxides. L.R.Morss (Chem. Div., Argonne Nat. Lab., Argonne, IL, USA).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.301-21 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
A systematic treatment of the thermochemical properties of binary and complex oxides of the lanthanides and actinides in terms of other well-characterized species and thermochemical cycles is given. Since the trivalent lanthanides provide a reference series with which the lanthanide and actinide sesquioxides can be compared, the trivalent ion energetics are considered first. Recent interest in monoxides, prompted by high pressure synthesis of lanthanide monoxides and interest in divalent actinide metals and oxides, has led the author to include a treatment of the relative stabilities of monoxides and sesquioxides. The important tetravalent state is viewed from the perspective of the dioxides as well as the perovskites $BaMO_3$. (86 refs.)

120669 Comparison of the solution chemistry of the actinides and lanthanides. G.R.Choppin (Dept. of Chem., Florida State Univ., Tallahassee, FL, USA).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.323-30 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
The chemical behavior of the lanthanide and actinide elements in aqueous media is compared for similarities and differences. The stability of oxidation states and the thermodynamic parameters of complexation are evaluated to reflect how the decreased shielding of the 5f orbitals relative to that of the 4f orbitals causes the actinides to have somewhat different properties from those

of the lanthanides. Although the interaction of the cations of both series with complexing ligands can be described satisfactorily by an ionic model, the free-energy and enthalpy values of complexation of the trivalent actinides indicate a slightly greater covalency in bonding than that of the comparable lanthanide complexes. This is seen particularly in the metal-nitrogen-bonded systems. (17 refs.)

Bond strengths of organothorium and organouranium compounds .... See Entry 118010

Crystallization of TCNQ salts from acetonitrile in the presence of association equilibria .... See Entry 118930

Theory of nucleation on charged cores. II. Thermodynamic parameters of an equilibrium nucleus .... See Entry 119149

Hydrogen bonding and other polar interactions of 1-,2-, and 4-octyne with organic solvents .... See Entry 119163

Solid-state electrochemical study of (gallium+antimony) liquid alloys .... See Entry 119227

Thermodynamic calculations for the chemical vapor deposition of silicon nitride .... See Entry 120256

Thermodynamic calculations for the chemical vapor deposition of silicon carbide .... See Entry 120257

Solid-state quaternary phase equilibrium diagram for the Hg-Cd-Te-O system .... See Entry 120316

Charge transfer in polar media. Transition-state entropy .... See Entry 120596

Metal carbonyl bond strengths: applications of photoacoustic calorimetry .... See Entry 120651

Solid state batteries with conducting polymers .... See Entry 120733

82.65 SURFACE PROCESSES

120670 Development of the reverse osmosis technique for water desalters. H.Loffler (VEB Wasseraufbereitungsanlagen Markkleeberg, Markkleeberg, Germany), J.Knebusch, M.Balke.
Chem. Tech. (Germany), vol.35, no.9, p.439-41 (Sept. 1983). In German.
Use of the method of reverse osmosis or of combined reverse osmosis and ion exchange, respectively, for water conditioning should be considered a meaningful supplementation of, rather than competition with, other methods of water treatment. Economic evaluation is, therefore, necessary to determine the economically most favorable technology of conditioning. There is sufficient evidence to show that this method affords major economic advantages for certain applications, it being important to note here that the use of conventional systems of complete softening (using ion exchangers) for salt contents greater than or equal to 20 mval/l is not generally possible for both process-engineering and economic reasons. A cellulose acetate-based winding module has been developed, of which the specifications are comparable to those of modules available on the international market. A suitable system technology has been developed on the basis of the winding module concept. (no refs.)

120671 Study of the porous structure and selective properties of membranes obtained by plasma polymerization in a glow discharge. Yu.I.Dytnerskii, A.A.Dmitriev, B.V.Mchedlishvili, I.L.Potokin (Polytech. Inst., Leningrad, USSR).
Colloid J. USSR (USA), vol.44, no.6, p.1024-8 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1166-9 (Nov.-Dec. 1982). [received: Sept. 1983]
The porous structure of ultrathin membranes obtained by plasma polymerization in a glow discharge has been studied by electron microscopy and mercury porosimetry. The dependence of the geometric parameters of the plasma-deposited membranes and their selective and adsorption properties in the filtration of proteins, lattices, and influenza and rabies viruses on the exposure time of the substrate in the flow discharge has been obtained. The applicability of these membranes to microfiltration separation has been evaluated. (7 refs.)

120672 A combined instrument for the investigation of catalytic reactions by means of gas chromatography, secondary ion and gas phase mass spectrometry, Auger and photoelectron spectroscopy, and ion scattering spectroscopy. O.Ganschow, R.Jede, L.D.An, E.Manske, J.Neelsen, L.Wiedmann, A.Benninghoven (Phys. Inst., Univ. Munster, Munster, Germany).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1491-506 (1983).
A combined instrument has been developed which couples a microreactor operated with technical catalysts with a combined surface analytical instrument. The microreactor is equipped with gas chromatography and gas phase mass spectrometry for continuous control of the reaction parameters. The surface analytical part of the instrument incorporates secondary ion and thermal desorption mass spectroscopy, Auger and photoelectron spectroscopy, and ion backscattering spectroscopy, all of which have been developed to their full versatility and efficiency. The transfer of the catalyst from the reactor to the surface analysis station is performed by a valveless lock within about one minute in a vacuum free of organic contaminations. The whole system can be operated fully under computer control. First applications of this instrument have been devoted to the oxidation of methanol to formaldehyde on silver catalysts. (18 refs.)

120673 Reverse osmosis membrane performance as affected by temperature and pressure. M.C.Dale, M.R.Okos (Dept. of Agricultural Engng., Purdue Univ., West Lafayette, IN, USA).
Ind. & Eng. Chem., Prod. Res. & Dev. (USA), vol.22, no.3, p.452-6 (Sept. 1983).
The flux rates of cellulose acetate reverse osmosis (RO) membranes decrease with time because of membrane compaction. The rate of compaction (and resultant flux decline) increases with increasing temperature and pressure. A model for flux decline due to compaction as a function of time, temperature, and pressure is presented and fitted to experimental data. The ability to predict compaction rates of RO membranes as a function of operating temperature and pressure should allow selection of optimal operating parameters and determination of the useful membrane life, all of which are very important factors in designing RO systems. An example of this sort of economic optimization is given. (13 refs.)

120674 Relation between lattice distortions and catalytic properties of cobalt-chromium spinel solid solutions. O.A.Antropova, A.I.Purtov, I.I.Kalinichenko, L.A.Baikova (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1619-21 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1883-5 (Nov. 1982).
A continuous series of solid substitutional solutions $Co^{II}(Co_x{}^{III}Cr_{2-x}{}^{III})O_4$ ($x=0$-2) and $Cu_y{}^{II}Co_{1-y}{}^{II}(Co_x{}^{III}Cr_{2-x}{}^{III})O_4$ ($0<y<1$, $0<x<2$), obtained by thermal decomposition of codeposited hydroxides of the corresponding metals at 600°C has been studied by X-ray analysis. The magnitudes of the distortions and dimensions of the regions of coherent scattering of X-rays (particle size) in the lattice of the spinel phase have been determined. It has been established that lattice deformations appear at the largest cation inhomogeneity of the composition of the starting codeposited hydroxides. The influence of lattice distortions on the catalytic activity of cobalt-chromium spinel solid solutions in the thermal decomposition of ammonium perchlorate has been demonstrated. (5 refs.)

120675 An electrochemical evidence of the O_2 photodesorption from n-TiO_2 surface. G.S.Popkirov (Central Lab. of Solar Energy & New Energy Sources, Acad. of Sci., Sofia, Bulgaria).
Phys. Status Solidi a (Germany), vol.79, no.1, p.323-6 (Sept. 1983).
Evidence of O_2 photodesorption from a n-TiO_2 surface is presented. The sample potential vs. reference electrode is monitored upon immersion of the sample into an electrolyte. The influence of illumination of the sample before the immersion, on the magnitude of the recorded voltage patterns, obtained upon immersion, is investigated. The results are discussed in terms of oxygen sorption processes and their influence on the n-TiO_2 surface energetics. (8 refs.)

120676 Electroconductivity of heterogeneous membranes MK-40 and MA-40 in 1:1, 1:2, 2:1 electrolyte solutions. M.P.Sidorova, I.Z.Bezhanidze, D.A.Fridikhsberg.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.58-63 (Aug. 1983). In Russian.
Considerable dependence of membrane electroconductivity upon outside solution concentration determined experimentally along with calculations using the three-conductor model make it possible to suppose that electric current passes through the membrane wholly on the resin matrix but through consecutive joints of helium parts of the matrix and interhelium intervals filled with free electrolyte solution. (7 refs.)

Material transport in hyperfiltration .... See Entry 117128

Comparison of photon-stimulated dissociation of gas-phase, solid and chemisorbed water .... See Entry 117942

Surface chemistry of polyacetylene .... See Entry 119311

The change in the composition and structure of glass surface during the interaction with salt melts .... See Entry 119324

Investigation of the sorption of stearic acid and its esters on steel .... See Entry 119332

A study of SO_2 adsorption on CaO (100) surfaces using X-ray photoelectron spectroscopy .... See Entry 119339

A study of valence band shake-up features of CO on Pt{100} using synchrotron radiation .... See Entry 119679

Surface-enhanced Raman spectroscopy of water: implications of the electromagnetic model .... See Entry 120040

Infrared studies of the effect of preadsorbed pyridine on the oxidation of butan-2-ol adsorbed on TiO_2 .... See Entry 120050

Chemical sputtering of carbon by sub-eV atomic hydrogen: new results and a critical comparison with previous data relevant to fusion applications .... See Entry 120209

Initial stages of oxide formation on HgCdTe exposed to activated oxygen .... See Entry 120464

Corrosion of a borosilicate glass by orthophosphoric acid .... See Entry 120471

Catalyzed and inhibited decomposition of ammonium perchlorate .... See Entry 120592

Synergistic effects for the $TiO_2/RuO_2/Pt$ photodissociation of water .... See Entry 120623

Polymerization of acetylene with new catalysts, new doping agents, morphology and electrical conductivity of the doped polyacetylene films .. See Entry 120627

82.70 DISPERSE SYSTEMS

(for flow behaviour, see 47.55K)

120677 Kinetic analysis of microemulsions using microprocessor controlled UV/visible-spectrometry. G.Gauglitz (Univ. of Tubingen, Tubingen, Germany).
TRAC Trends Anal. Chem. (Netherlands), vol.2, no.10, p.230-6 (Oct. 1983).
Microprocessor controlled spectrometers greatly extend the possibilities for kinetic analysis of complex thermal or photochemical reactions. as a result, more sophisticated evaluation procedures, such as derivative spectroscopy or dynamic multi-component analysis become possible. (16 refs.)

120678 Structural and mechanical properties of polydisperse suspensions of electrocorundum. A.F.Krivoshchepov, A.P.Tikhonov, L.V.Samuilova (D.I. Mendeleev Chem.-Engng. Inst., Moscow, USSR).
Colloid J. USSR (USA), vol.44, no.6, p.931-4 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1057-61 (Nov.-Dec. 1982). [received: Sept. 1983]
It has been shown that the formation of periodic colloidal structures (PCS) of different types occurs in ion-stabilized aqueous suspensions of electrocorundum, depending on the concentration, dispersity, and polydispersity of the filler. The existence of PCS_1 and PCS_2 fragments, which influence one another and form PCSs of a higher type, is possible in polydisperse systems. The degree of development of particular PCS fragments determines the rheological behaviour of suspensions in different ranges of shearing stresses. (11 refs.)

120679 Features of structure formation during vibration of aqueous solutions of clays. N.N.Kruglitskii, G.Z.Komskii, P.V.Kolotii (Inst. of Colloid Chem. & the Chem. of Water, Acad. of Sci., Kiev, Ukrainian SSR).
Colloid J. USSR (USA), vol.44, no.6, p.1037-40 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1177-80 (Nov.-Dec. 1982). [received: Sept. 1983]
The concentration dependence of structural-mechanical properties of clays and ceramic masses has been studied for different degrees of structure-destruction by shear deformation and by subjection to vibration. It has been established that the critical concentration for structure-formation in these systems increases regularly as the structure is increasingly destroyed. (9 refs.)

120680 A morphological description of the secondary structure of disperse carbon, synthesized by a polycondensation method. Yu.B.Nekrashevich, E.P.Smirnov, A.T.Denisova (Lensovet Leningrad Technol. Inst., Leningrad, USSR).
Colloid J. USSR (USA), vol.44, no.6, p.1041-3 (Nov.-Dec. 1982). Translation of: *Kolloidn. Zh. (USSR)*, vol.44, no.6, p.1181-2 (Nov.-Dec. 1982). [received: Sept. 1983]
The secondary structure of disperse carbon particles, formed by the polycondensation of chlorohydrocarbons, produced by the interaction of individual hydrocarbons and chlorohydrocarbons, is described. The dependence of the morphology of the product on the conditions of synthesis has been determined

and it has been shown that the type and secondary structure of the disperse carbon are determined mainly by the ratio of the numbers of chlorine, hydrogen, and carbon atoms is the numbers of chlorine, hydrogen, and carbon atoms in the molecules of the initial reagents, and by the length of time the reagents stay in the reaction zone. (6 refs.)

120681 Precise vapour-pressure measurements of the solubilization of benzene by aqueous sodium octylsulphate solutions. E.E.Tucker, S.D.Christian (Dept. of Chem., Univ. of Oklahoma, Norman, OK, USA).
Faraday Symp. Chem. Soc. (GB), no.17, p.11-24 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
Accurate vapour-pressure-solubility results have been obtained for aqueous solutions of sodium octylsulphate (SOS) and benzene at 15, 25, 35 and 45°C. Thermodynamic constants are reported for reactions of benzene with SOS monomers and micelles; hydrophobic effects are important in stabilizing the aggregates formed between monomeric benzene and SOS species. The observed non-linearity of degree of solubilization with benzene activity indicates that benzene molecules interact cooperatively within the micelles. A mass-action model, employing a form of the Poisson distribution equations modified to account for cooperativity, provides an excellent fit of all the solubilization data at each temperature. Activity coefficients are reported for benzene in the micellar species, as functions of temperature and micellar composition. (21 refs.)

120682 Comparative determination of the size of disk-shape colloid particles by conventional and electric light scattering. Thai Thanh Suong, S.Stoylov (Inst. of Phys. Chem., Bulgarian Acad. of Sci., Sofia, Bulgaria).
Izv. Khim. Bulg. Akad. Nauk. (Bulgaria), vol.15, no.4, p.542-52 (1982). [received: Sept. 1983]
Systematic investigations were carried out for particle size determination of various fractions of Na-bentonite. The average size values are determined by the Zimm-plots, by the disymmetry and by the electric light scattering from the decay curves and the saturation values of the electrooptic effect at complete particle orientation. The results permit the estimation of the applicability of the methods and the influence of some deviations from the Rayleigh-Debye-Gans theory on the range of applicability. (22 refs.)

120683 Study by conductimetry and polarimetry of aqueous solutions of quaternary ammonium bromides derived from L α-methyl benzylamine. R.Coudert (Lab. de Chimie Generale et Minerale, Faculte des Sci., Tours, France), R.R.Durand.
J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.6, p.537-41 (June 1983). In French.
A series of $d(+)$,$l(-)$ and $dl(\pm)$ N-alkyl, N,N,-dimethyl ammonium bromides proceeding from $d(+)$, $l(-)$ and $dl(\pm)$, α-methyl benzylamine, is prepared. The critical micelle concentration (CMC) is measured at 20°C, using conductimetry ($7 \leq m \leq 12$) for all species, and polarimetry ($4 \leq m \leq 12$) for optically active salts. The conductimetric measurements reveal no significant difference between the CMC of these optically active and racemic surfactants. Polarimetric determinations give the same CMC values for $d(+)$ or $l(-)$ salts, slightly greater than results of conductimetry. (20 refs.)

120684 Direct determination of free energies of colloidal dispersions. S.Maleki, C.S.Hirtzel, R.Rajagopalan (Dept. of Chem. & Environmental Engng., Rensselear Polytech.-Inst., Troy, NY, USA).
Phys. Lett. A (Netherlands), vol.97A, no.7, p.289-93 (12 Sept. 1983).
Helmholtz free energies of electrostatically-stabilized colloidal dispersions of monodispersed spherical particles have been obtained using computer experiments, Boltzmann sampling has been shown to be sufficient for determining free energy differences between two dispersions whose pair-potentials are close to each other. Non-Boltzmann sampling has been used when the pair-potentials differ substantially. These results have been compared with the results based on perturbation theory. The techniques used thus offer a direct method to test the latter. (15 refs.)

Second Annual Conference of the American Association for Aerosol Research ....See Entry 116918

10th Annual Conference of the Association for Aerosol Research (Gesellschaft fur Aerosolforschung) ....See Entry 116920

Rheological properties of nonaqueous polystyrene dispersions ....See Entry 118542

Diffusive, electrostatic, and gravitational deposition of suspensions in the entrance of a nozzle ....See Entry 118665

Study of the swelling of vermiculite-ornithine in salt solution by small-angle X-ray scattering analysis. Method of interpretation and investigation of the order parameters ....See Entry 118807

On the existence of micellar positional correlations in a type I nematic lyomesophase: an X-ray diffraction experiment ....See Entry 118862

Phase transitions of binary mixtures in random media ....See Entry 119155

High resolution electron microscopic study of oxide particles produced by the coalescence of smoke particles of iron and iron oxide ....See Entry 119213

Effects of inhomogeneities in polyacrylamide gels on thermodynamic and transport properties ....See Entry 119228

Diffusion of spheres in a concentrated suspension: resummation of many-body hydrodynamic interactions ....See Entry 119246

Investigation of the electrostatic charging of dispersed thermoplastics in fluidized systems ....See Entry 119689

Influence of diffusion of electrophoretic deposition in a uniform electric field ....See Entry 120636

Magnetic field effect on the hydrogen abstraction of xanthone from xanthene in SDS micelles ....See Entry 120664

82.80 CHEMICAL ANALYSIS AND RELATED PHYSICAL METHODS OF ANALYSIS

120685 Optimization of response of chemiluminescence analyzers. A.A.Mehrabzadeh, R.J.O'Brien, T.M.Hard.
Anal. Chem. (USA), vol.55, no.11, p.1660-5 (Sept. 1983).
The behavior of chemiluminescence analyzers is discussed in terms of the response equations for exponential-dilution and plug-flow reactors. Three operational modes are distinguished in each case, and their characteristics and advantages are treated. The response equations are tested experimentally with the ozone/ethylene chemiluminescent reaction. Application to the popular NO/O_3 analyzer is discussed. (12 refs.)

120686 Determination of total cyanide in thiocyanate-containing wastewaters. N.J.Csikai, A.J.Barnard,Jr. (Res. & Dev., J.T. Baker Chem. Co., Phillipsburg, NJ, USA).
Anal. Chem. (USA), vol.55, no.11, p.1677-82 (Sept. 1983).
At high acidities, thiocyanate reacts with nitrate or other oxidants to produce free cyanide. For thiocyanate-containing wastewaters, a total cyanide procedure is reported based on use of EDTA at pH 4.0, acetate buffered, to disrupt the complexes of cadmium, chromium, copper, iron, nickel, and zinc. Nitrite interference is obviated by adding sulfamic acid to the sample. Sulfides are removed from the sample by initial treatment with cadmium carbonate and, if necessary, from distillates with cadmium nitrate. (27 refs.)

120687 Trace element determination by atomic spectroscopic methods—state of the art. M.L.Parsons, S.Major, A.R.Forster (Dept. of Chem., Arizona State Univ., Tempe, AZ, USA).
Appl. Spectrosc. (USA), vol.37, no.5, p.411-18 (Sept.-Oct. 1983).
In the 15-year period between 1966 and 1981, detection limits for atomic spectroscopic methods of analysis have decreased by an average of 3 orders of magnitude. The 1982 state of the art for the atomic techniques in general use is presented and the methods compared using the detection limits as the figure of merit. (59 refs.)

120688 Time-resolved electrothermal atomic absorption spectra. N.J.Miller-Ihli, T.C.O'Haver, J.M.Harnly (Dept. of Chem., Univ. of Maryland, College Park, MD, USA).
Appl. Spectrosc. (USA), vol.37, no.5, p.429-32 (Sept.-Oct. 1983).
A wavelength-modulated continuum source atomic absorption spectrometer is used to obtain time-resolved atomic absorption spectra (absorbance vs. wavelength) using an electrothermal atomizer. Absorbance spectra are acquired at a rate of 56 Hz during atomization. The operator may choose any portion of the atomization time period to be examined as well as the number of absorbance profiles to be averaged. This time-resolved spectral information facilitates the positive identification of spectral interferences as well as providing for detailed inspection of both analyte and background absorption signals. Several interferences are examined. (11 refs.)

120689 A critical evaluation of the tangential flow torch microwave-induced plasma detector for gas chromatography. S.R.Goode, B.Chambers, N.P.Buddin (Dept. of Chem., Univ. of South Carolina, Columbia, SC, USA).
Appl. Spectrosc. (USA), vol.37, no.5, p.439-43 (Sept.-Oct. 1983).
The tangential-flow torch was evaluated as part of an atomic emission microwave plasma detector for gas chromatography. Emission intensities for the elements carbon, sulfur, and bromine in a variety of organic molecules were studied. Calibration plots showed good linearity, indicating that the chemical matrix has little effect on the relative degree of atomization. (18 refs.)

120690 Quantitative determination of deuterium in laser fusion targets by inverse Raman spectroscopy. G.R.Daigneault, M.D.Morris, R.G.Schneggbenburger (Dept. of Chem., Univ. of Michigan, Ann Arbor, MI, USA).
Appl. Spectrosc. (USA), vol.37, no.5, p.443-6 (Sept.-Oct. 1983).
Quantitative measurements of deuterium partial pressures in laser fusion targets are made by inverse Raman spectroscopy. Attenuation of atmospheric nitrogen inverse Raman signals is used for standardization of the system. This technique allows calibration curves to be made with long path gas cells. The measurements are accurate to ±20%. (13 refs.)

120691 Raman microprobe analysis of thin films formed on the surface of silver electrical contacts utilizing the surface-enhanced Raman scattering effect. H.Ishida, A.Ishitani (Phys. Chem. Lab., Toray Res. Center, Otsu, Japan).
Appl. Spectrosc. (USA), vol.37, no.5, p.450-5 (Sept.-Oct. 1983).
The laser Raman microprobe has been used in combination with Auger electron spectroscopy for the investigation of thin films formed on the surface of polycrystalline silver relay contacts to illustrate the analytical application of the surface-enhanced Raman scattering (SERS) phenomenon to the evaluation of industrial materials. Raman scattering of thin carbon layers on Ag evaporated films has also been examined in order to confirm the enhancement effect on the Ag surface. From the observed enhanced Raman scattering, carbon and sulfur compounds such as silver sulfate have been identified in the thin films formed in Ag contacts operated repeatedly under several kinds of controlled gas flows. These results demonstrate the possibility of a wide range of application of the SERS effect as a useful analytical method with a high surface sensitivity. (19 refs.)

120692 Indirect determination of oxidant concentration using resonance Raman spectra of dyes. H.Baranska, A.Labudzinska, J.Mlodecka (Inst. of Industrial Chem., Warsaw, Poland).
Appl. Spectrosc. (USA), vol.37, no.5, p.476-7 (Sept.-Oct. 1983).
In their previous work the authors reported the quantitative analysis of aqueous solutions of indigocarmine for concentrations of 10^{-4} to 10^{-5} M. As a continuation of that work, they attempted the next logical step, the use lof indiglocarmine as a quantitative indicator for the indirect determination of an oxidant in a redox system. In this particular experiment, the indigocarmine solution loses its color when it is oxidized. In this oxidation, the structure of the chromophore group in the molecule changes and analytical bands in the RR spectrum disappear. In the present experiment, they used hydrogen peroxide as the oxidant. (2 refs.)

120693 Online sensors for trace metals based on stripping analysis. J.Wang (New Mexico State Univ., Las Cruces, NM, USA).
Am. Lab. (USA), vol.15, no.7, p.14-22 (July 1983).
Stripping analysis is a sensitive, precise, and economical electroanalytical technique for measuring heavy metals. The three requirements for efficient online monitoring—sensitivity, speed, and stability—are present in stripping analysis flow systems. This report describes the design, characteristics, and applications of various flow systems for stripping analysis. (8 refs.)

120694 Radionuclides—tools for analysis and process control. H.Vogg (Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Germany).
TRAC Trends Anal. Chem. (Netherlands), vol.2, no.10, p.236-9 (Oct. 1983).
Radionuclide techniques have made major contributions to research and development in analysis and process control. A high degree of specialization is now required for the successful development of further, unique, practical applications. (33 refs.)

120695 Measurements of K_0-values for (n, γ) reactor neutron activation analysis. Zhou Yunlu, Shan Huamin, Zhang Wenhua (Inst. of the Nonferrous Metals, Beijing, China).
He Huaxue Yu Fangshe Huaxue (China), vol.4, no.4, p.216-27 (Nov. 1982). In Chinese. [received: Sept. 1983]
K_0-values of 15 nuclides used in reactor neutron activation analysis were measured with a degree of reproducibility (2-10%). Measurements were carried out at different irradiation conditions ($8 < \Phi_{th}/\Phi_e < 117$) using ^{97}Ru and ^{103}Ru as flux ratio monitor and comparator nuclides at the heavy water reactor of Institute of Atomic Energy. In the measurements of K_0-values, the non-$1/E$ epithermal spectrum, the burn-up of target, the true coincidence

effects of γ-rays in cascade and the measurement geometry were considered and the consequent errors corrected. (12 refs.)

120696 Applications of AES and XPS to characterization of aluminium and its compounds. R.L.Tapping, I.Aitchison, D.G.W.Goad (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada).
Can. J. Spectrosc. (Canada), vol.28, no.3, p.87-94 (1983).
Chemical shifts and the Auger parameter, plasma energy losses and lineshape analysis are secondary aspects of Auger electron spectroscopy and X-ray photoelectron spectroscopy that may provide useful insights into chemical bonding, alloy composition, and the reliability of some quantitative methods of analysis. These procedures are outlined and discussed with reference to results obtained for some aluminium intermetallics and compounds. (27 refs.)

120697 Status report on ASTM E-42 Committee on surface analysis. P.H.Holloway (Dept. of Materials Sci. & Engng., Univ. of Florida, Gainesville, FL, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1570-3 (1983).
Recognizing that surface analysis is rapidly becoming very important in a number of industrial installations and processes, a group of scientists within the American Society for Testing and Materials formed a group which was aimed at producing standards and recommended practices for this field. Initially, this activity was conducted as a subcommittee of ASTM E-02 Committee on Emission Spectroscopy but in 1976 the activity was transferred to a new committee within ASTM, E-42 Committee on Surface Analysis. The purpose of this committee is to advance the field of surface analysis (both in quality and breadth) through the development of appropriate standards, standard practices, reference data, reference materials, round robins, symposia, workshops, and publications. The committee currently has approximately 140 members and a wide sphere of influence through cooperating scientists and laboratories both within the United States and around the world. (5 refs.)

120698 Electron microprobe techniques for routine compositional analysis of (Hg,Cd)Te. T.M.Moore (Central Res. Labs., Texas Instruments Inc., Dallas, TX, USA).
J. Vac. Sci. & Technol. A (USA), vol.1, no.3, p.1651-5 (1983). (Proceedings of the 1983 US Workshop on the Physics and Chemistry of Mercury Cadmium Telluride, Dallas, TX, USA, 8-10 Feb. 1983).
Specialized data reduction methods have been applied to the quantitative X-ray analysis of (Hg,Cd)Te infrared detector materials in the scanning electron microscope. These methods provide a rapid and reliable characterization tool suitable for routine use in a process control environment. The technique is applicable to the entire composition range and provides submicron spatial resolution for compositional profiling of epitaxial layer cross sections. (14 refs.)

120699 Improved laser technique for high sensitivity atomic absorption spectroscopy in flames. E.A.Whittaker, P.Pokrowsky, W.Zapka, K.Roche, G.C.Bjorklund (IBM Res. Lab., San Jose, CA, USA).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.4, p.289-96 (Oct. 1983).
Frequency modulation laser spectroscopy is utilized for high sensitivity detection of trace species aspirated into a flame of the type commonly used for atomic absorption spectroscopy (AAS). The method is applied to the detection of sodium atoms in an air-acetylene flame and data are obtained on the distribution of ground and excited state populations as a function of height above the burner. Absorptions as small as 1.5×10^{-4} may be detected with a signal-to-noise of one. With multi-passing, a detection limit of 3.3×10^6 sodium atoms/cm^3 was obtained. (20 refs.)

120700 Current mode operation: a technique for improving the reliability of zirconia oxygen probes in reducing atmospheres. W.E.Borbidge, P.T.Whelan (Div. of Chem. Phys., CSIRO, Clayton, Victoria, Australia).
J. Appl. Electrochem. (GB), vol.13, no.4, p.519-29 (July 1983).
A technique is described whereby zirconia oxygen sensors with platinum electrodes can be protected from deterioration in reducing atmospheres, typical of metallurgical heat treatment conditions. By the application of current to the sensor, the technique provides a form of anodic protection, while at the same time the oxygen concentration in an atmosphere varying in temperature and composition can be continuously detected and measured. (14 refs.)

120701 Use of infrared spectroscopy to identify crystalline aluminium hydroxides of the $Al(OH)_3-Fe(OH)_3$ system. E.Wolska, W.Szajda (Lab. of Magnetochem., Adam Mickiewicz Univ., Poznan, Poland).
J. Appl. Spectrosc. (USA), vol.38, no.1, p.137-40 (Jan. 1983). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.38, no.1, p.160-4 (Jan. 1983).
The authors present an example of the use of absorption spectroscopy to identify crystalline aluminium hydroxides in a system also containing hydrated iron oxide. Spectroscopic identification of the coprecipitated products is based on an analysis of the absorption bands due to vibrations of OH groups in the ranges of bending and stretching vibrations. (14 refs.)

120702 Measurement of impurities in a multi-doped sample of cadmium mercury telluride. J.B.Clegg (Philips Res. Labs., Redhill, England), J.B.Mullin, K.J.Timmins, G.W.Blackmore, G.L.Everett, R.Snook.
J. Electron. Mater. (USA), vol.12, no.5, p.879-89 (Sept. 1983).
A comparative analytical study has been carried out on a specially doped specimen of cadmium mercury telluride using different analytical techniques in order to calibrate solid source mass spectrographic (SSMS) analyses. It has been shown that the conventional techniques for standardisation of SSMS that assumes that the ionisation, transmission and collection efficiency of all elements are equal is incorrect with this matrix and can significantly overestimate the impurity concentration. Enhancement factors for a range of elements have been determined which permit quantitative analyses to be made. (10 refs.)

120703 The chemical structure of conducting polyheterocyclic films: XPS studies. P.Pfluger, G.B.Street (IBM Res. Lab., San Jose, CA, USA).
J. Phys. Colloq. (France), vol.44, no.C-3, p.609-14 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).
X-ray photoemission spectroscopy is used to characterize conducting pyrrole and thiophene polymer films. The results are essentially in agreement with α-α' linking of the aromatic rings, but very significant degrees of disorder may occur. Not always is the anion dissolved in the electrolyte for the preparation or for electrochemical cycling of the films found as such in the conducting polymer. Only in the very early stage of oxidation does the doping of neutral polypyrrole proceed by homogeneous charge extraction from the polymeric pyrrole subsystem. At higher doping levels, the N atom of the pyrrole ring provides a reactive site for dehydrogenation and oxygenation reactions. (15 refs.)

120704 A microcomputer-based injection system for investigating the influence of atmospheric pressure on chromatographic response in the analysis of gases. B.R.Wybrow (Res. & Dev. Div., London Res. Station, British Gas Corp., London, England), E.J.Greenhow.
J. Autom. Chem. (GB), vol.5, no.3, p.124-35 (July-Sept. 1983).
In gas chromatographic analysis, in order to assist automation and to improve precision, gas samples are usually injected by means of a gas-sampling valve which is connected to a sample loop of fixed volume. (5 refs.)

120705 Use of pattern-recognition display techniques to visualize the data contained in complex data-bases. A case study. M.P.Derde, D.L.Massart (Farmaceutisch Inst., Vrije Univ. Brussel, Brussels, Belgium), W.Ooghe, A.De Waele.
J. Autom. Chem. (GB), vol.5, no.3, p.136-45 (July-Sept. 1983).
The purpose of the article is to show that pattern-recognition methods can be used to visualize the data and therefore to gain insight into them. These methods are called display methods. This is demonstrated with a practical example: the authentification of the geographical origin of wine. Applications in, for example, archeometry, meteorites, microbiology and medical diagnosis are also feasible. Pattern recognition is a natural addition to automated analysis: eventually there will be instruments which can analyse samples, determine the patten to which a sample corresponds, and suggest its geographical origin. (22 refs.)

120706 Identification of vulcanized mixtures of rubbers by the IR-absorption spectrophotometry. B.Antczak, B.Krajewska (Inst. Przemyslu Gumowego Stomil, Piastow, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.28, no.4, p.132-4 (April 1983). In Polish. [received: Oct. 1983]
Identification is based on a comparison between the intensity of the characteristic absorption bands of the individual polymers and the intensity of 1450-1470 cm^{-1} band present in all the polymers under study. The possibility of detection depends both on the content of the individual rubber components and on the intensity of characteristic absorption bands. (5 refs.)

120707 Standard function and analysis errors in spectrochemical analysis. II. Weighted regression with variable precision of measurement. H.Bubert, R.Klockenkamper (Inst. fur Spektrochem. & Angewandte Spektroskopie, Dortmund, Germany).
Spectrochim. Acta Part B (GB), vol.38B, no.8, p.1087-98 (1983). In German.
For pt.I see ibid., vol.378, no.2, p.127 (1982). Calibration is a basic operation generally required for spectrochemical analyses. It provides the calibration function through which, by means of mathematical inversion, the analytical function is indirectly accessible. The general case is investigated in which the precision of measurement is not constant but depends on the measuring quantity; it is frequently described by $s_0(I)=(\beta_0{}^2+\beta_1{}^2 I+\beta_2{}^2 I^2)^{1/2}$. By means of a so-called noise analysis the β-coefficients have then to be established and calibration functions must be determined by a weighted regression with factor $1/s_0{}^2$. Admissible are simple, also non-linear functions with few coefficients only, which are calculated so that the least possible errors can be expected in the full measuring range. If 'well-fitting' functions are selected, these errors are proportional to $s_0(I)$ and not essentially higher. The weighting is demonstrated with two examples of spectrochemical analyses: the determination of La in aqueous solutions by ICP-AES and the determination of Zn in brass by XRF. Additionally, it is shown that the 'logarithmic' and the 'relative' regression are in principle similar and actually represent a weighted regression; they are applicable only, however, if the relative precision of the measurements is constant. (12 refs.)

120708 Properties of the cadmium determination with the platform furnace and Zeeman background correction. W.Slavin, D.C.Manning, G.Carnrick, E.Pruszkowska (Perkin-Elmer Corp., Norwalk, CT, USA).
Spectrochim. Acta Part B (GB), vol.38B, no.8, p.1157-70 (1983).
Cadmium is easy to determine with the combination of the stabilized temperature platform furnace, appropriate matrix modification and Zeeman background correction. The optimized conditions were suitable for many matrices; seawater and urine were explored in some depth. Natural water samples were analyzed for Cd. The matrix modifier included ammonium phosphate and either $Mg(NO_3)_2$ or NaCl. Simple working curves were used. Problems associated with char losses were studied and recovery experiments were shown to expose such problems. The concept of characteristic amount, the mass of analyte that produced a 1% absorption signal (0.0044 abs), especially using integrated absorbance data, was shown to be a very powerful diagnostic tool for graphite furnace work. The characteristic amount for Cd was 0.35 pg/0.0044 abs-s, and it varied little with variations in experimental conditions. The effect of background signals that were evolved rapidly was to disrupt the Zeeman signal. Guidance is provided in identifying and controlling these problems. The advantage of the Zeeman technique in providing improved detection limits using bright sources was explored. (78 refs.)

120709 Determination of nonvolatile components of complex mixtures by headspace analysis. B.V.Ioffe, V.V.Larionov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.112-14 (Aug. 1983). In Russian.
The possibility of accurate determination of nonvolative components and complete analysis of mixtures by combining headspace gas chromatography and refractive index of liquid phase data are illustrated using the example of the ternary system urea-isopropyl alcohol-water. (3 refs.)

120710 New concepts in the state-of-the-art of pH measuring equipment. S.Lichtenstein (Orion Research Inc., Cambridge, MA, USA).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.461-71
Two products have been introduced that significantly improve the performance characteristics, precision, and accuracy of a pH measuring system. A new pH meter uses a technique called 'log R compensation' to produce temperature-corrected pH values without the need for a separate temperature compensator. A new pH electrode, named the Ross electrode, has a unique internal element/solution system that eliminates thermal hysteresis associated with conventional calomel or silver/silver chloride (Ag/AgCl) electrodes. (no refs.)

Sensitivity factors for XPS analysis of surface atoms .... See Entry 116934

A special-purpose microcomputer in instrumentation .... See Entry 117155

A new background-correction method for atomic absorption spectrometry .... See Entry 117236

Determination near the limit of detection with a sequential scanning inductively coupled plasma emission spectrometer .... See Entry 117237

Continued development of direct aerosol introduction in constant temperature furnace atomic absorption spectroscopy .... See Entry 117240

An introduction to inductively coupled plasma source mass spectrometry .... See Entry 117243

Multiplex detection in a combined laser optoacoustic spectrometer-chromatograph ....See Entry 117249

Effect of axial injection of argon on conventional spectrochemical excitation sources at atmospheric pressure. I. Behavior of line intensities and their profiles under various experimental conditions ....See Entry 117251

Nonmetal excitation in helium, neon, and argon microwave plasmas ....See Entry 117252

The capacitatively coupled microwave plasma (CMP) as atomisation source in atomic absorption spectral analysis ....See Entry 117253

Separative column atomizer (SCA) for direct analysis by atomic absorption spectrometry. GC separation characteristics ....See Entry 117254

Determination of absolute atomic concentration by the saturated vapour total absorption method ....See Entry 117255

Interfacing a transit-time mass spectrometer to a minicomputer ....See Entry 117273

Mass spectrometry of negative ions. A practical application . See Entry 117274

X-ray fluorescence analysis using the Chem-X low power wavelength dispersive spectrometer ....See Entry 117305

Chromatographic determination of gas-like impurities in a dissociating coolant ....See Entry 117613

Multichannel amplitude analyzer using the 'MERA-60' microcomputer ....See Entry 117735

Target factor analysis of the ultraviolet spectra of unresolved liquid chromatographic fractions ....See Entry 117883

Liquid crystal orientation on inorganic surfaces ....See Entry 118872

Two different species of deuterium implanted into a pyrolytic graphite observed by XPS-SIMS ....See Entry 119039

Depth profile of hydrogen in thin films with elastic recoil detection technique ....See Entry 119049

Analysis of hydrogen concentration and its depth profile in solid with detection of H(d,p) recoil ....See Entry 119050

On concentration dependence of partition coefficients between liquid and gas phases ....See Entry 119166

Interaction of thin layers of Al and Ge with cleaved (Hg,Cd)Te surfaces ....See Entry 119279

A study of SO_2 adsorption on CaO (100) surfaces using X-ray photoelectron spectroscopy ....See Entry 119339

(HgCd)Te-SiO_2 interface structure ....See Entry 119353

Residual shallow acceptors in GaAs layers grown by metal-organic vapor phase epitaxy ....See Entry 119364

Applications of the modulated liquid crystal-linear dichroism (LC-LD) to spectro- and stereo-chemical problems. III ....See Entry 120019

Studies on polynuclear molybdates in the aqueous solution by laser Raman spectroscopy ....See Entry 120091

Secondary ion mass spectroscopy applications in semiconductor technology: III-V compound and other material structures ....See Entry 120213

The reactive sputtering of tantalum oxide: compositional uniformity, phases, and transport mechanisms ....See Entry 120245

Cleaning effect of rare earths on grain boundary segregation in steels ....See Entry 120331

Surface oxidation of molten soft solder: an Auger study .... See Entry 120497

Mass-spectrometric study of the behavior of molybdenum di- and triiodide during heating to 743K ....See Entry 120603

EPR and IR investigation on cis-trans isomerization and oxidation of polyacetylene films ....See Entry 120614

Ultrasonic detection of free radicals decay in polyethyl methacrylate ....See Entry 120621

Investigation of some products of photolysis of aqueous solutions of GMP ....See Entry 120663

A combined instrument for the investigation of catalytic reactions by means of gas chromatography, secondary ion and gas phase mass spectrometry, Auger and photoelectron spectroscopy, and ion scattering spectroscopy ....See Entry 120672

Study by conductimetry and polarimetry of aqueous solutions of quaternary ammonium bromides derived from L α-methyl benzylamine ... See Entry 120683

γ-ray spectrometric determination of uranium-series nuclides in marine phosphorites ....See Entry 121379

FANTASIA—a program for target transformation factor analysis to apportion sources in environmental samples ....See Entry 121387

The instrument for the determination of dissolved oxygen in seawater ....See Entry 121410

Application of the atomic Voigt effect for the determination of the trace elements (Ag, Pb, Rb) ....See Entry 121411

82.90 OTHER TOPICS IN PHYSICAL CHEMISTRY

120711 A correlation of solvated electron absorption spectra with the solvent parameter $E_T(30)$. H.D.Burrows (Chem. Dept., Univ. of Ife, Ile-Ife, Nigeria).
Radiat. Phys. & Chem. (GB), vol.19, no.2, p.151-4 (1982). [received: Oct. 1983]
A linear correlation is observed between the energy of solvated electron absorption maxima and the values of the empirical solvent parameter $E_T(30)$ for 24 of the 29 solvent systems on which data is available. The correlation spans a wider range of solvent polarity than similar correlations with iodide ion absorption spectra. Of the five solvents which do not give a good correlation, three are amides, and it is suggested that reported solvated electron spectra in these cases may, instead, be due to radical anion absorptions. (32 refs.)

86.00 ENERGY RESEARCH AND ENVIRONMENTAL SCIENCE

86.10 ENERGY RESOURCES AND THEIR UTILISATION

(inc. economic aspects; for nuclear engineering and nuclear power studies, see 28.00)

120712 Occupational risks of energy production. L.A.Cox, J.Fiksel, A.S.Kalelkar (Arthur D. Little Inc., Cambridge, MA, USA), P.F.Ricci.
Nucl. Saf. (USA), vol.24, no.4, p.459-70 (July-Aug. 1983).
A number of technical and methodological issues in the application of process analysis to occupational health risk assessment are discussed, and an illustrative case study is presented. The case study estimates the occupational risks associated with several specific energy technologies that are likely to be used in the next two decades. The nominal plants selected and their supporting fuel cycles range from conventional fossil fuel plants to a solar thermal power plant. Several major sources of uncertainty in the risk assessment are indicated, and a method is provided for dealing with this uncertainty when interpreting risk estimates. (14 refs.)

120713 Finland's energy supply and domestic energy. E.Vaara (Kauppaja Teollisuusmin., Energiaosasto, Helsinki, Finland).
Saehkoe Electr. & Electron. (Finland), vol.56, no.9, p.22-6 (Sept. 1983). In Finnish.
No major changes in Finland's energy supply are foreseeable in the near future. The consumption of coal will increase considerably in the next few years with the rise in the consumption of electricity. The future potential and competitiveness of Finnish industry and the national economy will be major considerations in deciding on large new power stations. (no refs.)

120714 Mobilization of renewable energies for development. R.Gicquel, Y.Lambert.
Rev. Energ. (France), vol.34, no.356, p.505-15 (Aug.-Sept. 1983). In English, French.
Shows that renewable energies are potential constituents and an appreciable complement to classic energy forms, particularly in the agricultural and rural sector. Also reviews their various applications, and then examines ways in which it would be possible to mobilize these energies at an increasing rate in the developing countries. (no refs.)

120715 EFOM 12C case studies. Candidate technologies in the European energy systems: United Kingdom case study. S.C.Littlechild, J.L.Morris, K.G.Vaidya.
Report EUR 8459 EN, Comm. European Communities, Luxembourg (1983), 40 pp. Contract EM2-068-UK(H).
The EFOM 12c model is used to assess the potential contribution of some new energy technologies. Cost and demand assumptions are reviewed and constraints on nuclear electricity capacity and assumptions on demand for energy and industrial output are modified to reflect recent revisions of energy projections. Choice of new technologies included in the model is based on an ETSU assessment. The technologies included are conservation, synthetic natural gas, synthetic natural oil, solar, FBR, pressurised fluidised bed combustion, wave and wind power and combined heat and power. (6 refs.)

86.10B Fossil and other fuels

Five year testing with the Texaco coal gasification plant in Oberhausen-Holten (BRD) ....See Entry 120768

86.10D Wind energy

120716 A theoretical model for estimating the capacity credit of wind power in the presence of correlation between wind speed and electricity demand. J.Carlin (Div. of Maths. & Statistics, CSIRO, Canberra, Australia).
Sol. Energy (USA), vol.31, no.5, p.511-15 (1983).
Haslett and Diesendorf have employed analytic models allowing a qualitative investigation of the variation of capacity credit with a wide range of grid, aerogenerator and load parameters. This note extends their work by describing a model which is capable of representing the joint variation of load and wind and hence does not require the assumption that these two variables are uncorrelated. This assumption has invariably been made in previous work, although there is general recognition that some correlation often exists (generally positive due to common diurnal or seasonal cycles in the two variables). Under the model introduced, estimates of capacity credit may be obtained by numerical calculation. Results are presented. Simple analytic expressions are not in general available for the integrals involved, but some simplifications are made for the special cases of unit and zero correlation, and small and large penetrations. These parallel and extend the results of Haslett and Diesendorf. (10 refs.)

86.10F Tidal and flow energy

(inc. water-wave energy)

120717 On the optimization of the operation of tidal power plants; application of the back-and-forth shooting method. P.J.Orava, T.J.Eirola.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.152-8 (1983).
A simple mathematical model is used for describing the operation of a hydro-electric tidal power plant with a single basin and with bi-directional bulb turbines capable also for the pump modes. The plant of La Rance at the Gulf of St. Malo, France, is used as a typical reference case, where the tide is of the lunar semidiurnal type, as in general at the coasts of the northern Atlantic. The optimization of the dynamic operation is studied via the Pontryagin's maximum principle and thereby the two-point boundary-value problem (TPBVP). The so-called back-and-forth shooting method is used in the computational solution of the TPBVP. Some preliminary results are presented and discussed, as well as further plans for research are sketched. (18 refs.)

86.10H Geothermal energy

120718 Direct use geothermal PON and PRDA projects under DOE-ID administration annual report FY 1982. F.W.Childs, R.D.Sanders (EG&G Idaho Inc., Idaho Falls, ID, USA).
Geothermal Energy (USA), vol.11, no.3, p.11-14 (March 1983).
This report presents the status of geothermal PRDA and PON projects administered by the DOE-ID as of the end of FY-1982. Both programs were instituted to assist the development of the direct application of geothermal energy. The PRDA Program consists of a series of studies designed to investigate the engineering and economic feasibility of geothermal direct applications. The PON Program consists of demonstration projects in which project costs are shared between DOE and the private companies, municipalities, or organizations. During this reporting period, fiscal year 1982, EG&G Idaho provided program management and technical support for 12 demonstration projects and five engineering and economic studies. Each project is summarized. (no refs.)

86.10K Solar energy

120719 Optimal water cost from solar-powered multieffect distillation. B.W.Tleimat (Water Thermal & Chem. Technol. Center, Univ. of California, Berkeley, CA, USA).
Desalination (Netherlands), vol.44, p.153-65 (May 1983).
Presents a short review of solar distillation followed by a description of conventional distillation methods and associated energy consumption. The paper then presents a system where solar energy is used to generate steam to drive a multieffect distillation plant. The system is optimized on the basis of minimum water cost. The analysis shows that enhancement of heat-transfer coefficients in the distillation section and increasing steam temperature from solar boiler result in lower water cost as well as increase the output per unit area of solar collectors. This study shows that a solar boiler producing saturated steam at 60°C in combination with an evaporator-condenser, developed and tested at the authors laboratory, resulted in minimum water costs ranging from \$1.40 to \$3.70 per m^3 for brackish water feed and \$2.15 to \$4.70 per m^3 for seawater feed. At these conditions, the daily productivity per unit area of solar collectors ranged from 45 to 130 liters per m^2. This study also shows that when the steam temperature was increased from 60°C to 88°C, the minimum water cost decreased from \$2.15/m^3 to \$1.37/m^3 for brackish water feed and from \$3.60/m^3 to \$2.05/m^3 for seawater feed. Also, at these conditions, the daily productivity per unit area of solar collector increased to 288 l/m^2 for brackish water feed and to 151 l/m^2 for seawater feed. These predicted values for the daily productivity of simple solar stills at the assumed value of solar insolation. (8 refs.)

120720 Solar energy: prospects for Austria.
Elektron Int. (Austria), no.7-8, p.197 (1983). In German.
A brief account is given of the research and development programmes in Austria on direct utilization of solar energy by means of heat exchangers, heat pumps and photovoltaic solar cells. The work is supported by Shell Austria, ASSA (the Austrian solar energy and space research association) and the Ludwig Boltzmann Solid State Physics Institute. (no refs.) *S.R.*

120721 Dish concentrators for solar thermal energy. L.D.Jaffe (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
J. Energy (USA), vol.7, no.4, p.304-12 (July-Aug. 1983).
A wide variety of point-focusing concentrators are under consideration for solar thermal energy use. They are briefly reviewed. This paper surveys the design and development of dish concentrators and discusses briefly the cost and performance needed. Overall system and site design and such subsystems as receiver, engine, generator, and controls are touched on only as they impact concentrator characteristics. (9 refs.)

120722 Economic feasibility of retrofit solar hot water systems. R.R.Somers, M.R.Sexton (Univ. of Virginia, Charlottesville, VA, USA), A.C.Pritchard, M.C.Hoffman, L.S.Fletcher.
J. Energy (USA), vol.7, no.4, p.325-31 (July-Aug. 1983).
This paper presents the results of an economic feasibility study of 177 public buildings (schools, hospitals, local government buildings, and public care facilities) in the Commonwealth of Virginia to determine if active flat-plate solar collector systems could economically augment or replace existing hot water heating installations. Utilizing the F-CHART method and life-cycle costing techniques, two collector areas were determined for each facility: the optimum collector area (where the present worth of the lifetime net savings was maximized) and the maximum collector area (where the amount of solar energy that could be utilized without losing money was maximized). Solar systems that would pay for themselves within 25 years could be installed in 77 of the 177 buildings (43.5%), with a mean discounted payback period of 17.7 yr. These units would provide 78.8% of the facilities' hot water loads. The study also reveals that for a given fuel cost, the collector areas of these systems are directly proportional to the total hot water loads. In addition, the shortest discounted payback period of an optimally designed solar system may be obtained directly from the fuel cost. These relationships could lead to simplified sizing techniques for active solar hot water system retrofits. (14 refs.)

120723 Solar thermal technologies: potential benefits to US utilities and industry. K.L.Terasawa, W.R.Gates (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
J. Energy (USA), vol.7, no.4, p.361-6 (July-Aug. 1983).
Solar thermal technologies (STT) represent an important element of solar energy research efforts. STT provides a renewable and environmentally attractive source of thermal and electrical power, which can be utilized in a broad range of applications servicing a variety of economic sectors. STT complements nuclear and coal technologies as a means of reducing US dependence on imported petroleum. The net present value of the energy cost savings attributable to STT in electric utility and industrial process heat applications is estimated for alternative future energy cost scenarios and alternative production cost for solar thermal technology. Under reasonable assumptions regarding future fuel prices and STT production cost, the expected benefits of developing an STT option are significant. Despite these benefits, private investment in STT reserarch and development is unlikely, due to the high level of uncertainty characterizing both future energy prices and the expected returns from such research. Federal participation is required if cost-competitive STT systems are to be available during this century. (10 refs.)

120724 Economic possibilities of installation of solar plants for heating water. A.A. Arata (Univ. Tecnica Federico Santa Maria, Valparaiso, Chile).
Scientia (Chile), vol.46, no.156-157, p.72-9 (Jan.-Dec. 1981). In Spanish. [received: Sept. 1983]
Presents at a level of preinvestment study, the economic possibility of installation of solar plants for heating water in the Northern and Central zone of Chile. The analysis considers the incidence of the increase of energy costs in order to obtain the economic indicator per zone. (4 refs.)

120725 Solar geometry for fixed and tracking surfaces. J.E.Braun, J.C.Mitchell (Solar Energy Lab., Univ. of Wisconsin, Madison, WI, USA).
Sol. Energy (USA), vol.31, no.5, p.439-44 (1983).
A general expression for the solar radiation incidence angle in terms of the slope and surface azimuth is derived for both fixed and tracking surfaces. Using this expression, relationships for the slope and azimuth of optimally tracked one- and two-axis tracking surfaces are developed. This information is necessary in determining incident solar radiation based upon horizontal measurements. (7 refs.)

120726 The utilizability function. I. Theoretical development of a new approach. J.M.Gordon, Y.Zarmi (Jacob Blaustein Inst. for Desert Res., Ben-Gurion Univ. of the Negev, Sede Boger, Israel).
Sol. Energy (USA), vol.31, no.6, p.529-36 (1983).
A new theoretical approach to the calculation of the utilizability function is developed and applied to the case of the annual performance of solar collectors of high concentration ratio. The utilizability is calculated in mathematical closed form as an integral over the contributions of the daylight hours of one representative day, equinox. The daily variations in the instantaneous solar radiation are represented by random fluctuations superimposed on the clear day radiation pattern. The results are compared with detailed meteorological data. A simple and practical analytic expression for the utilizability is derived for the limiting case of clear climates, and provides accurate predictions for the utilizability for all climates. The presentation is in two parts: the current paper details the theory and derivation, and the following paper gives solved examples and practical comparisons. (11 refs.)

120727 Estimates of irradiance over Zimbabwe. G.Lewis (Faculty of Engng., Univ. of Zimbabwe, Harare, Zimbabwe).
Sol. Energy (USA), vol.31, no.6, p.609-12 (1983).
The irradiance incident on a horizontal surface in a given location can be estimated from commonly-observed and/or easily obtained meteorological and geographical parameters. This technique is of interest to less developed countries where solar radiation measuring instruments are scarce. This report gives the results of a regression analysis of measured monthly mean values of daily irradiance, daily sunshine hours duration and daily relative humidity. From these results estimates of irradiance over selected locations in Zimbabwe were obtained. (11 refs.)

First World Congress on Desalination and Water Re-Use .... See Entry 116916

Solar thermal engine systems using two stage concentrators . See Entry 120754

High temperature solar gas heating comparison between packed and fluidized bed receivers. I .... See Entry 120758

Simulation of an absorption heat pump solar heating and cooling system .... See Entry 120759

Mathematical programming procedures to optimize the collector field subsystem of a power tower system .... See Entry 120760

A solar powered diaphragm pump .... See Entry 120761

The utilizability function. II. Validation of theory against data-based correlations .... See Entry 120762

Analysis of concentrating collectors of energy from a distant point source .... See Entry 120763

Thermodynamic equation of state approach for the choice of working fluids of absorption cooling cycles .... See Entry 120764

An improved design method for solar water heating systems .. See Entry 120765

Daily efficiency of flat-plate solar air collectors for grain drying .... See Entry 120766

Visualization of optical and thermal performance of solar components using encapsulated liquid crystals .... See Entry 120767

Analysis and design of a differential sunshine recorder .... See Entry 121404

Techniques for the precise estimation of hourly values of global, diffuse and direct solar radiation .... See Entry 121405

86.10N Nuclear energy

120728 Role of nuclear power in Pakistan. M.Ahmad (Chashma Nuclear Power Project, Islamabad, Pakistan).
Nucleus (Pakistan), vol.20, no.1, p.3-10 (Jan.-March 1983). [received: Oct. 1983]
The paper reviews the energy demand and supply position in Pakistan and stresses the need for tapping nuclear energy in view of the limitations of conventional energy resources. It is shown that even under conditions of modest economic growth and with the maximum exploitation of available hydro and other resources, the country would still be compelled to install a large block of nuclear generating capacity over a period of next two decades to meet its power needs. A cost-comparison between nuclear and coal/oil-fired units brings out a decided tilt in favour of nuclear plants which has led the government to decide on the construction of the country's second nuclear plant at Chashma scheduled for completion by 1989. (no refs.)

86.30 ENERGY CONVERSION

86.30D Electrochemical conversion: general

(for superionic conductors, see 66.30H)

120729 Decomposition of β-alumina in an oxygen potential gradient. K.T.Jacob (Dept. of Metall. & Materials Sci., Univ. of Toronto, Toronto, Canada).
J. Appl. Electrochem. (GB), vol.13, no.4, p.469-72 (July 1983).
Single phase sodium β-alumina solid electrolyte was found to undergo isothermal phase separation in electrochemical cells, where a large oxygen potential gradient was imposed across the electrolyte and electrodes, not reversible to sodium ions, were short circuited. The experimental conditions and evidence of decomposition are outlined and a thermodynamic explanation for the phenomenon is given. This finding may lead to new methods for making multilayered ceramic materials involving ionic conductors. (2 refs.)

The development of the reference standard cells and its prediction method .... See Entry 117200

Conductive polymers as electrode materials .... See Entry 120644

86.30F Secondary cells

120730 The technology of the Li/Cl_2 in SO_2Cl_2 cell system. IV. High temperature performance, storability, and safety characteristics. R.M.Murphy, C.C.Liang (Electrochem Industries Inc., Clarence, New York, NY, USA).

J. Appl. Electrochem. (GB), vol.13, no.4, p.439-49 (July 1983).

Tests were conducted to determine the performance, storability, and safety characteristics for specially designed Li/Cl_2 in SO_2Cl_2 (Li/CSC) cells at temperatures as high as 150°C. Discharge tests at 150°C showed that practical Li/CSC D cells yield energy densities of 0.75 to 0.91 Wh cm^{-3} for constant resistive loads of 3.0 to 75.0 ohms, respectively. Further, the performance results obtained for cells stored at 150°C and either discharged at 25°C or discharged at 150°C showed little loss in realised capacity but exhibited a noted loss in rate capability. These cells have been subjected to abusive conditions such as short circuit, forced overdischarge, incineration, puncture, and shock sensitivity testing following prolonged discharge at both ambient and elevated temperatures. Safety/hazard testing has also included specific combinations of the above abusive conditions. The results relative to the safe, efficient use of the cells at elevated as well as room temperatures will be discussed. (11 refs.)

120731 The technology of the Li/BrCl in $SOCl_2$ inorganic battery system: performance and self-discharge characteristics following long-term storage. P.W.Krehl, C.C.Liang (Electrochem Industries Inc., Clarence, NY, USA).

J. Appl. Electrochem. (GB), vol.13, no.4, p.451-8 (July 1983).

Investigations were conducted on Li/BrCl in $SOCl_2$ cells to determine both the performance and shelf life characteristics after storage for a period of one year at various temperatures. Room temperature discharge test results indicate that there is little self-discharge in those cells stored at either room temperature or at −40°C. Even when the cells were subjected to elevated storage temperatures, the discharge results show that the cells exhibit a low self-discharge rate. However, cells stored at an elevated temperature do exhibit a decreased rate capability when compared to those results obtained from fresh cells. From the 56 ohm load discharge performance results, the self-discharge rate for cells stored at −40, 24, 50 and 72°C was calculated. Further, the activation energy over the temperature range was found to be 27.6 ± 1.7 kJ. Also, the self-discharge rate was monitored under light load conditions. The results for Li/BrCl in $SOCl_2$ D cells discharged under a current density of 2.38 to 0.016 mA cm^{-2} show that the operationally induced self-discharge rate reaches a maximum of 4.5 μA cm^{-2} for cells discharged under a current density of 0.034 mA cm^{-2} and decreases to 2.9 μA cm^{-2} as the discharge current density decreases to 0.016 mA cm^{-2}. These data indicate that the self-discharge rate for cells discharged under very light loads may eventually approach that for cells stored under open circuit conditions. (2 refs.)

120732 Electrochemical cells employing polyacetylene and poly(p-phenylene) as active materials. L.W.Shacklette, R.L.Elsenbaumer, R.H.Baughman (Corporate Res. Center, Allied Corp., Morristown, NJ, USA).

J. Phys. Colloq. (France), vol.44, no.C-3, p.559-65 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).

The electrochemical behavior of polyacetylene and poly(p-phenylene) is discussed in terms of band-structure and crystal structure. (9 refs.)

120733 Solid state batteries with conducting polymers. F.Beniere, D.Boils, H.Canepa, J.Franco, A.Le Corre, J.P.Louboutin (Sci. des Materiaux, Univ. de Rennes I, Rennes, France).

J. Phys. Colloq. (France), vol.44, no.C-3, p.567-72 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).

The conducting polymers like $(CH)_x$ are very interesting materials for electrodes in electrochemical cells. The authors have combined such electrodes with solid electrolytes to build 'all solid-state' batteries. The first prototypes using a silver anode and a silver conducting electrolyte have been working satisfactorily for two years. The performances have been tested with many batteries to study the electrical properties as well as the thermodynamical parameters. A number of cycles of charge-discharge have been recorded at various values of the current kept constant. This has allowed them to determine the essential properties: voltage, current, current density, reliability, Faradaic and energetic efficiency... The performances have also been investigated as a function of temperature, allowing them to derive the enthalpy and the entropy of the electrochemical reaction. The kinetics of the discharge has been thorough—fully measured and compared to mass transport data recently obtained by using radiotracers. This has given a clear explanation of the mechanism of mass transport inside the polymer. (15 refs.)

120734 Lightweight, stable, and rechargeable battery and capacitor with activated carbon fiber electrode. T.Nogami, H.Mikawa, M.Nawa (Dept. of Appl. Chem., Osaka Univ., Osaka, Japan).

J. Phys. Colloq. (France), vol.44, no.C-3, p.573-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).

The authors have made a rechargeable battery and an electric double layer capacitor by use of an activated carbon fibre as the electrode material. (10 refs.)

120735 $(CH)_x$ as an electrode material: some properties during the electrochemical process. P.Bernier (Groupe de Dynamique des Phases Condensees, Univ. de Sci. et Tech. du Languedoc, Montepellier, France), A.El-Khodary, F.Maurice, C.Fabre, P.Mirebeau, A.M.Ledunois.

J. Phys. Colloq. (France), vol.44, no.C-3, p.583-6 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).

The authors have studied the behaviour of p-type doped $(CH)_x$ electrodes in rechargeable batteries $(CH)_x$/1M $LiClO_4$ in PC/Li. They have measured the cell voltage under constant current, the coulombic efficiency versus the charge state and estimated the importance of side reactions. Furthermore they have deduced the ClO_4^- diffusion coefficient in the solid material and evaluated the limit number of charge-discharge cycles with an amplitude of 0.07 electrons per CH unit. (5 refs.)

Electric field enhanced diffusion in polyacetylene ....See Entry 119283

The aqueous and non-aqueous electrochemistry of polyacetylene: application in high power density rechargeable batteries ....See Entry 120643

Management of excess energy in autonomous photovoltaic systems ....See Entry 120743

86.30J Photoelectric conversion: solar cells and arrays

120736 Maximum power consideration in lossy solar cells. B.Prasad (Dept. of Phys., Univ. of Roorkee, Roorkee, India), K.Gopal, N.M.Ravindra, S.Robin.

Int. J. Electron. (GB), vol.55, no.4, p.681-4 (Oct. 1983).

A simple technique is presented which eases the requirements for maximum power consideration in solar cells with resistive losses. This technique is based on the well known general condition for maximum power $dP=(\partial P/\partial I)\, dI+(\partial P/\partial V)\, dV=0$. The present analysis is made for a real solar cell, one with both series and shunt resistances present simultaneously. (2 refs.)

120737 A method for the measurement of solar cell series resistance. V.N.Singh, R.P.Singh (Dept. of Phys., Banaras Hindu Univ., Varanasi, India).

J. Phys. D (GB), vol.16, no.10, p.1823-5 (14 Oct. 1983).

A simple method is suggested for measuring the series resistance of a solar cell which utilises only a single I-V curve at a moderate light intensity level. (6 refs.)

120738 Review of conductor-polymeric semiconductor solar cells. J.Kanicki (Chimie Organique Phys., Univ. Libre de Bruxelles, Bruxelles, Belgium).

J. Phys. Colloq. (France), vol.44, no.C-3, p.529-35 (June 1983). (Conference Internationale sur la Physique et la Chimie des Polymeres Conducteurs (International Conference on the Physics and Chemistry of Polymer Conductors), Les Arcs, France, 11-15 Dec. 1982).

The photovoltaic properties of Schottky barrier, heterojunction and photoelectrochemical cells involving organic polymers are reviewed. (13 refs.)

120739 Operational experience with flat plate photovoltaic systems. V.V.Risser, P.Hutchinson, S.Durand (New Mexico Solar Energy Inst., Las Cruces, NM, USA).

J. Energy (USA), vol.7, no.4, p.332-7 (July-Aug. 1983).

In 1977-8 the US Department of Energy initiated a program to obtain experience in the operation and maintenance of intermediate-sized photovoltaic systems. After evaluation of competitive proposals, four flat-plate and five concentrator-type photovoltaic systems were selected for construction. This paper describes the first-year operational results of two of the flat-plate systems, both located in the semiarid climate of the southwestern United States. The 20 kW system in El Paso, Texas, has been operating since January 1981. The 100 kW system in Lovington, New Mexico, has been operating since March 1981. A complete project record is maintained by using an extensive instrumentation system that records performance data and weather information at each site. This information is augmented by recording all required maintenance activity on the system. The New Mexico Solar Energy Institute is monitoring performance and assisting with maintenance on both systems. Performance to date is encouraging for those interested in this alternate energy technology. It clearly shows that successful operation of large-scale flat-plate systems is achievable today. (no refs.)

120740 A simple solar cell series resistance measurement method. J.Cabestany, L.Castaner (ETSI Telecommunicacion, Barcelona, Spain).

Rev. Phys. Appl. (France), vol.18, no.9, p.565-7 (Sept. 1983).

A new and simple technique to evaluate the series resistance of a solar cell is described. This procedure only needs dark I(V) measurements and a simple experimental-arrangement including a calibrated standard resistor. Comparison with other commonly used methods is also discussed. (4 refs.)

120741 Photovoltaic cells illuminated in spectra splitting. I. Comparative study of the $Ga_{1-x}Al_xAs$-Si and GaAs-Ge coupled solar cells under concentrated light. A.Chave, J.R.Leguerre (Lab. d'Energie Solaire, Faculte des Sci., Rabat, Morocco).

Rev. Phys. Appl. (France), vol.18, no.9, p.569-86 (Sept. 1983). In French.

Presents a study of the photovoltaic behaviour of a set two systems each of which has two solar cells $Ga_{1-x}Al_xAs$-Si and GaAs-Ge coupled with a dichroic mirror in sunlight. The model of each system shows the influence of physical and technological parameters on the photocurrents and efficiency of the cells. The analysis is performed under concentrated light taking into account the losses due to series resistance, shadowing ratio and temperature effect. The minimization of losses gives the optimum of the grid metallic pattern profile. The $Ga_{0.7}Al_{0.3}As$-Si system under air-mass yields a maximum efficiency of 30.4% with solar concentration of 750, and the GaAs-Ge coupled system yields a maximum efficiency of 25-5% with solar concentration of 600. (19 refs.)

120742 Photovoltaic cells illuminated in spectral splitting. II. Electric coupling of two different type of solar cells. A.Chave, J.R.Leguerre (Dept. de Phys., Faculte des Sci., Rabat, Morocco).

Rev. Phys. Appl. (France), vol.18, no.9, p.587-94 (Sept. 1983). In French.

For pt.I see ibid., vol.18, no.9, p.569-86 (1983). In the electric coupling of two different types of solar cells, the I(V) characteristic is modified. If the two cells are illuminated in spectral splitting with a dichroic mirror the cut-off energy at the point of maximum power efficiency is a function of the physical parameters values, slope of the mirror and solar concentration. The authors determine the optimization conditions of the system and in particular the variations of the grid metalization, shadowing ratio and cell temperature. The power conversion efficiency of the series coupling is similar to the isolated cells, but shows a very high sensitivity with respect to the variation of parameters. (no refs.)

120743 Management of excess energy in autonomous photovoltaic systems. E.Ofry, S.Singer (Faculty of Engng., Tel-Aviv Univ., Ramat Aviv, Tel-Aviv, Israel).

Sol. Energy (USA), vol.31, no.5, p.445-8 (1983).

A new method is described for the absorption of the excess energy generated in autonomous solar systems with the use of a variable complementary load. In order to use the excess energy for ventilation of the system, a fan is used as the complementary load. The current flow through the batteries is controlled according to the ampere-hour (A/hr) rule by regulating the fan in such manner that it absorbs all excess power. The energy control unit, including the fan, is part of a 1.6 kW peak, stand-alone, solar system built at Tel-Aviv University. (3 refs.)

120744 Solar cells—a technology assessment. J.R.Bolton (Dept. of Chem., Univ. of Western Ontario, London, Ontario, Canada).

Sol. Energy (USA), vol.31, no.5, p.483-502 (1983).

After a brief introduction including an analysis of limits on solar-cell conversion efficiencies and their dependence on temperature and light intensity, the bulk of the review deals with an extensive analysis of present and future solar-cell technologies. The three established technologies of Si cells, CdS/Cu_2S cells and GaAs cells are thoroughly examined in terms of manufacturing processes, advantages, disadvantages, efficiencies, applications and further reading. Several emerging technologies are then treated including the heat exchange method (HEM), the edge-defined film-fed growth (EFG) ribbon process, the dendritic web growth process, advanced Czochralski processes, alternative methods of fabricating cells from single-crystal Si such as ion implantation and MIS junctions, polycrystalline Si cells, amorphous Si cells, CdS/$CuInSe_2$ cells, GaAs cells and photoelectrochemical cells. In each case prospects for commercial development are assessed. Advanced concepts such as multi-junction cells, emerging semiconductor materials and organic cells are treated briefly. Concentrator systems and cells designed specifically for high light levels are analyzed and assessed as to commercial viability. Finally, the technology assessment is summarized in terms of ten specific points. (157 refs.)

120745 Surface modification of polycrystalline p-$CuInS_2$ and p-$CuInSe_2$ electrodes for improved solar cell performance. H.J.Lewerenz, H.Goslowsky (Hahn-Meitner-Inst., Kernforschung Berlin GmbH, Berlin, Germany), F.A.Thiel.
Sol. Energy Mater. (Netherlands), vol.9, no.2, p.159-66 (July-Sept. 1983).
The improvement of output power characteristics upon etching and Ru^{3+}-chemisorption is reported for polycrystalline p-$CuInS_2$ and p-$CuInSe_2$, $CuInS_2$ in V(II)/V(III) redox solution exhibits a simulated solar conversion efficiency of 2.5% and is stable upon passage of 5000C. The existence of Fermi level pinning is discussed. (21 refs.)

120746 Chemical deposition of $Cd_{1-x}Hg_xS$ thin film electrodes for liquid-junction solar cells. J.F.McCann, R.C.Kainthla (School of Phys., Univ. of New South Wales, Kensington, NSW, Australia), M.Skyllas-Kazacos.
Sol. Energy Mater. (Netherlands), vol.9, no.2, p.247-51 (July-Sept. 1983).
Thin films of $Cd_{1-x}Hg_xS$ alloys have been prepared by chemical co-deposition from thiourea solutions. By increasing the Hg content in the alloys the band-gap of the mixed semiconductor was reduced to a value of 1.8 eV, approaching that of n-CdSe. The stability of the films in polysulphide under illumination was also tested. (8 refs.)

120747 The description of detecting signals by laser scanning optoacoustic microprobe [solar cells testing application]. Zhang Yousong, Wang Lianjie (Changchun Inst. of Appl. Chem., Acad. Sinica, Changchun, China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.227-33
An experimental equipment of the laser scanning optoacoustic microprobe with a CW CO_2 laser as a light probe is described. It has been used in the investigation of the defects of sintering CdS/Cu_2S solar cells and other samples. The overlapping phenomena of the resonant wave of optoacoustic signals, the time-submerging phenomena of optoacoustic signals, the choice of the resolution for optoacoustic graph and the abnormal signal have been investigated. The results provide a new method that can be used for detecting some defects and for investigating polycrystalline surface regularity of sintering CdS/Cu_2S solar cells and other samples. (8 refs.)

^{60}Co γ-ray and electron irradiation damage of GaAs single crystals and solar cells .... See Entry 119066

Structural and optical studies of topotaxially-grown Cu_2S from sprayed CdS thin films .... See Entry 119374

Electrical, optical, and structural properties of semitransparent metallic layers .... See Entry 119718

Solar energy: prospects for Austria .... See Entry 120720

86.30K Photoelectrochemical conversion

120748 Fluorescent window as wavelength shifter for a polysulfide containing photoelectrochemical cell. N.Muller, J.Manassen (Dept. of Plastics Res., Weizmann Inst. of Sci., Rehovot, Israel).
Sol. Energy Mater. (Netherlands), vol.9, no.2, p.207-16 (July-Sept. 1983).
It is possible to obtain a gain in conversion efficiency of a photoelectrochemical cell by the use of a fluorescent wavelength shifter. If the dye is chosen so that its adsorption and fluorescence spectrum fits the photocurrent onset of the cell, gains in efficiency can be found. By the use of fluoresceine in methanol solution as the shifter and a polysulfide electrolyte, gains of up to 6% can be obtained with a $CdSe_{0.65}Te_{0.35}$ electrode and up to 10% with a CdSe electrode. The effect is also observed when using plastic sheets, doped with the dye. If the dimensions of the sheet exceed those of the cell on appreciable concentrating effect is observed. These effects are found either using a xenon light source or direct sunlight and are not corrected for constant quantum flux. With light which is richer in low wavelength radiation, much higher gains are obtained which is important for the concentration of diffusion light. Uranyl doped glass gives shifting effects, but these are too small to give a measurable gain in efficiency. (13 refs.)

Review of conductor-polymeric semiconductor solar cells .... See Entry 120738

Solar cells—a technology assessment .... See Entry 120744

86.30P Photosynthesis

(see also 87.25 Cellular biophysics)

120749 Materials from biomass. P.Vasudevan, D.Kumari, T.Sampath Kumar (Centre for Rural Dev. & Appropriate Technol., Indian Inst. of Technol., New Delhi, India).
J. Sci. & Ind. Res. (India), vol.42, no.1, p.14-18 (Jan. 1983). [received: Sept. 1983]
The material potential of biomass is analysed under four heads: polymer materials and composites; chemicals obtained by the degradation of high molecular weight compounds; naturally occurring low molecular weight compounds; and high molecular compounds which can be synthesized from the chemicals in groups B and C. An integrated approach to utilization of biomass is discussed. (33 refs.)

Phosphorence and state of chlorophyll in solutions .... See Entry 120658

86.30Q Chemical energy conversion

(for electrochemical conversion, see 86.30D; for photoelectrochemical conversion, see 86.30K)

Energy storage using the BaO_2-BaO reaction cycle .... See Entry 120770

86.30R Thermal energy conversion (heat engines and heat pumps)

120750 Energy from the ocean [OTEC].
Elektron Int. (Austria), no.7-8, p.198-202 (1983). In German.
It is estimated that 66% of the world energy consumption from fossil fuels, could be replaced by conversion of marine thermal energy in seaborne power stations utilising the temperature gradient of oceans, between the warm surface and colder water at a depth. The progress of research and development of pilot marine power schemes in the USA and Japan is reviewed, considering also prospects of production of other resources in parallel with the electric power generation, including desalination of water, minerals, fuels, foodstuffs and fertilisers. (no refs.) *S.R.*

120751 Air conditioning system study and application using thermosiphon. F.Matsuura, M.Mitsumachi, M.Nakao, M.Ichimura.
Electr. Commun. Lab. Tech. J. (Japan), vol.32, no.6, p.1373-82 (1983). In Japanese.
As heat generation per unit area from switching equipments increases, cooling in the switching room is frequently necessary, even in winter. The thermosiphon system has been studied as a cooling system in the high heat generating switching room. As no refrigerant circulation power is required in the thermosiphon system, it can be expected that energy consumption will be greatly reduced when this system is used with ordinary air conditioning system. They describe the system characteristics and the power estimation in an application example. (1 ref.)

120752 Heat pumps in district heating return pipelines to achieve greater temperature differences. U.Hezel (Energieversorgung Schwaben AG, Stuttgart, Germany).
Fernwaerme Int. (Germany), vol.12, no.4, p.202-6 (Aug. 1983).
The return pipeline is not a natural resource with its energy available for free. Instead, the medium has to be heated up in a heating plant, which means that both energy inputs at the heat pump, at the vaporizer and at the compressor drive demand the consumption of prime energy. Therefore, a heat pump at the return pipe cannot change some worthless energy from the environment into valuable energy as it does under other conditions. And thus it merely functions as a temperature transformer. Since any transformation process goes along with losses, the heat pumps increase the prime energy need of the network as a whole. (10 refs.)

120753 Ocean thermal energy conversion: historical highlights, status, and forecast. G.L.Dugger, D.Richards, E.J.Francis, W.H.Avery (Johns Hopkins Univ., Laurel, MD, USA).
J. Energy (USA), vol.7, no.4, p.293-303 (July-Aug. 1983).
In 1881, d'Arsonval conceived the closed-Rankine-cycle ocean thermal energy conversion (OTEC) system in which a working fluid is vaporized by heat exchange with cold water drawn from a 700-1200 m depth. In 1930, Claude demonstrated an open-cycle process in Cuba. Surface water was flash-vaporized at 3 kPa to drive a turbine directly (no secondary working fluid) and then was condensed by direct contact with water drawn from a 700-m depth through a 1.6-m-diam, 1.75-km-long cold-water pipe (CWP). From a ΔT of 14°C his undersized turbine generated 22 kW. In 1956 a French team designed a 3.5-MW (net) open-cycle plant for installation off Abidjan on the Ivory Coast of Africa and demonstrated the necessary CWP deployment. (46 refs.)

120754 Solar thermal engine systems using two stage concentrators. E.Kritchman (Enrico Fermi Inst., Univ. of Chicago, Chicago, IL, USA).
Sol. Energy (USA), vol.31, no.5, p.449-53 (1983).
The overall efficiency of a system including a solar paraboloidal concentrator augmented by a new type of nonimaging second stage concentrator (shaped like the bell of a trumpet) and coupled to a heat engine is investigated. Typically, a relative increase of 10 per cent in system efficiency was found due to the second stage. (9 refs.)

Solar energy: prospects for Austria .... See Entry 120720

Optimum mass flow rate of water in a flat plate solar collector coupled with a storage tank and an organic Rankine cycle power loop .... See Entry 120757

Simulation of an absorption heat pump solar heating and cooling system .... See Entry 120759

86.30S Photothermal conversion

120755 Future technological applications of rare-earth-doped materials. R.Reisfeld (Dept. of Inorganic & Analytical Chem., Hebrew Univ. of Jerusalem, Jerusalem, Israel).
J. Less-Common Met. (Switzerland), vol.93, no.2, p.243-51 (1983). (Proceedings of the Sixteenth Rare Earth Research Conference, Tallahassee, FL, USA, 18-21 April 1983).
The possible uses of rare-earth-doped glasses or crystals are discussed in connection with (a) luminescent solar concentrators (LSCs), (b) light sources for fibre optics and (c) glass lasers. LSCs can be made from glasses which absorb the major part of the solar spectrum and concentrate the emitted fluorescence at wavelengths to which the photovoltaic cells are most sensitive. The ways in which such glasses can be prepared using a combination of UO_2^{2+} or Cr^{3+} with Nd^{3+} and Yb^{3+} are discussed. An economical analysis of the new type of collector is given. The use of Er^{3+} in fluoride glasses for fibre waveguide sources is outlined and recent results are presented. References are made to new laser materials based on Er^{3+} and Ho^{3+}. (33 refs.)

120756 Materials for photothermal solar energy conversion corrosion processes. W.F.Bogaerts (Inst. for Industrial Chem., Univ. of Leuven, Leuven, Belgium), C.M.Lampert.
J. Mater. Sci. (GB), vol.18, no.10, p.2847-75 (Oct. 1983).
Commerically or potentially available selective and non-selective absorber surfaces for solar heat collectors are reviewed and the state-of-the-art of solar collector corrosion processes is outlined. The review of available published literature has indicated that a lack of quantitative information exists, relative to corrosion of collector surfaces. Available information (mostly qualitative) on durability aspects and corrosion of solar receiver surfaces is described to indicate potential corrosion problem areas and corrosion prevention possibilities. An outline of appropriate durability tests is presented. (178 refs.)

120757 Optimum mass flow rate of water in a flat plate solar collector coupled with a storage tank and an organic Rankine cycle power loop. S.M.Eldighidy, I.S.Taha (Mech. Engng. Dept., King Abdulaziz Univ., Jeddah, Saudi Arabia).
Sol. Energy (USA), vol.31, no.5, p.455-61 (1983).
The optimum flat plate solar collector operation for maximizing solar organic Rankine cycle work output is investigated. A mathematical model for the flat plate solar collector water system integrated with a solar storage tank and an organic Rankine cycle loop is developed. The mass flow rate of water is searched for to obtain the maximum network output from the integrated system during 1 yr of operation. Curve fittings of thermodynamic properties of some chosen organic fluids (R-11, R-21 and R-113) are derived for computer use. The Hooke and Jeeves optimization technique is used to determine the optimum mass flow rate of water in the collector for different values of collector inner tube diameters and boiler heat transfer coefficient-area product. (8 refs.)

120758 High temperature solar gas heating comparison between packed and fluidized bed receivers. I. G.Flamant, G.Olalde (Lab. d'Energetique Solaire, Font-Romeu, France).
Sol. Energy (USA), vol.31, no.5, p.463-71 (1983).
Present investigation has been concerned with high temperature gas heating through porous media (SiC and ZrO_2 particles) in both fluidized bed receiver and a packed bed receiver. As a rule, gases being transparent to solar radiation, the porous media act as (i) an absorber, (ii) a gas-solid heat exchanger. The main thermal features of the systems have been measured using the 6.5 kW solar furnace of the 'Laboratoire d'Energetique Solaire' in Odeillo, France. Theoretical approach, temperature profile, gas outlet temperature as a function of mean flux density, and thermal efficiency of the receiver have been reported. Great improvements of the thermal efficiency may be expected from the newly designed receivers. (23 refs.)

120759 Simulation of an absorption heat pump solar heating and cooling system. M.O.McLinden, S.A.Klein (Solar Energy Lab., Univ. of Wisconsin, Madison, WI, USA).
Sol. Energy (USA), vol.31, no.5, p.473-82 (1983).
An absorption heat pump (AHP) is a heat driven heat pump utilizing the absorption process. A continuous, liquid absorbent AHP with chemical storage is modeled using mass and energy balances and assuming mass transfer equilibrium. This model is used with the TRNSYS program (Klein et al., 1981) to simulate the performance of an AHP in a residual solar-driven heating and cooling system. The effects of collector area for an AHP using the NaSCN-NH_3 chemical system are investigated for the Columbia, MO, Madison, WI, and Fort Worth, TX climates. The AHP system is compared to a conventional solar heating and cooling system and the effects of heat exchanger effectiveness, storage mass, additional thermal capacitance and alternative control strategies are studied for the Columbia climate. (13 refs.)

120760 Mathematical programming procedures to optimize the collector field subsystem of a power tower system. O.Coskunoglu (Dept. of General Engng., Univ. of Illinois, Urbana, IL, USA).
Sol. Energy (USA), vol.31, no.5, p.503-10 (1983).
The collector field of a solar tower system can be viewed as being composed of cells, each of which contains arrays of heliostats. Optimal design of a collector field involves determining the number, spacing and arrangement of heliostats within each cell so that the total cost per unit energy is minimized. This optimal design problem is formulated as a mathematical programming (MP) problem. This MP problem is then decomposed into two subproblems. The first subproblem is to determine the optimal spacing, arrangement, and amount of mirror surface in each cell so that the total energy collected is maximized. It is shown that the dynamic programming (DP) procedure can be employed to solve this subproblem. DP is particularly effective and efficient for this subproblem because it has the capability of determining the optimal design of one cell at a time, in a recursive fashion, until all cells are designed. This cellwise decomposition significantly simplifies the computational procedure. Furthermore, the optimal energy collected can be determined parametrically as a function of the total mirror area used in the field. This function is then utilized in the second problem: determination of the optimal total area so that the total cost over total energy, both functions of total area, is minimized. This yields a fractional programming problem. Mathematical structure of the above problems, advantages of using mathematical programming concepts, and future research needs are also discussed. (26 refs.)

120761 A solar powered diaphragm pump. R.Burton (Dept. of Mech Engng., Papua New Guinea Univ. of Technol., Lae, Papua New Guinea).
Sol. Energy (USA), vol.31, no.5, p.523-5 (1983).
The pump has its primary fluid (water) circulating between the collector array and a vapour generator in which the working fluid is boiled. Also a hydraulically coupled feed pump permits condensed working fluid to be returned from the condenser to the vapour generator. Finally poppet valves are used to control the inlet and exhaust of vapour to the pump. These valves are externally operated by a lever. Brief technical details of the pump are outlined. Test results and their analysis is presented. (3 refs.)

120762 The utilizability function. II. Validation of theory against data-based correlations. J.M.Gordon, Y.Zarmi (Jacob Blaustein Inst. for Desert Res., Ben-Gurion Univ. of the Negev, Sede Boger, Israel).
Sol. Energy (USA), vol.31, no.6, p.537-43 (1983).
For pt.I see ibid., vol.31, no.6 (1983). The results of a new theoretical approach to the calculation of annual utilizability are illustrated and validated against utilizabilities that are based on detailed meteorological data. The theory is applied to concentrating solar collectors with tracking about two axes, the polar axis, the horizontal east-west axis, and the horizontal north-south axis, for a wide range of clearness index values. A new simple analytic formula for annual utilizability and its accuracy for the case of concentrating collectors is presented. The theoretical results provide a method for the prediction of utilizability curves for concentrating solar collectors in any climate using the annual average clearness index only. This is valuable for geographical locations and climates which are not covered by existing correlations or for which insufficient meteorological data exists. (7 refs.)

120763 Analysis of concentrating collectors of energy from a distant point source. D.C.Look,Jr., P.D.Sundvold (Mech. & Aerospace Engng. Dept., Univ. of Missouri, Rolla, MO, USA).
Sol. Energy (USA), vol.31, no.6, p.545-55 (1983).
A procedure to analyze the energy leaving a point source, being reflected from one surface and striking another, was applied to focusing collectors. This very flexible method is independent of flux, magnitude of reflectivity, or location of the source. It was applied to parabolic and circular cylindrical reflector surfaces for three different materials when the source was a function of wavelength. The overall collector efficiency was found and the flux striking the receiver, the monochromatic collector efficiency as a function of wavelength, and the spatial collector efficiency as a function of the reflector position are present. (12 refs.)

120764 Thermodynamic equation of state approach for the choice of working fluids of absorption cooling cycles. A.L.Gomez, G.A.Mansoori (Dept. of Chem. Engng., Univ. of Illinois, Chicago, IL, USA).
Sol. Energy (USA), vol.31, no.6, p.557-66 (1983).
A methodology is developed for the application of thermodynamic equations of state of fluids and fluid mixtures in evaluating working fluid combinations of absorption cooling cycles. Thermodynamic phase equilibrium formulation of this methodology is presented. In the application of this approach for the comparative study and choice of working fluids, the Redlich-Kwong equation of state is used for a number of possible working fluid combinations for solar absorption cooling cycles. It is demonstrated that when limited experimental data is at hand this approach could be a useful screening technique for potential working fluid combinations. (18 refs.)

120765 An improved design method for solar water heating systems. J.E.Braun, S.A.Klein, K.A.Pearson (Solar Energy Lab., Univ. of Wisconsin, Madison, WI, USA).
Sol. Energy (USA), vol.31, no.6, p.597-604 (1983).
The f-chart method is an accurate tool for sizing domestic water heating systems with well-insulated tanks. A more general and fundamental design procedure called the ϕ,f-chart method has been developed for closed-loop liquid-based solar heating systems. In this paper, the $\bar{\phi},f$-chart method is extended to open-loop solar hot water heating systems. This method is an improvement over the f-chart method since it does not impose any restrictions on the water set temperature, water mains temperature, or the preheat tank loss coefficient. The procedure is general for both one-tank and two-tank systems. The modified $\bar{\phi},f$-chart method is still applicable to the closed-loop systems for which it was originally developed. (10 refs.)

120766 Daily efficiency of flat-plate solar air collectors for grain drying. Kuan-Chong Ting (Dept. of Mech. Technol., Univ. of Houston, Houston, TX, USA), G.C.Shove.
Sol. Energy (USA), vol.31, no.6, p.605-7 (1983).
Single cover flat-plate solar collectors incorporated into walls and roofs of farm buildings have been used to heat ambient air for low temperature grain drying systems. Large surface area and high airflow rate are common features of these collectors. The objective of this study was to develop a simple means of direct calculation of a collector's daily efficiency based on its design parameters. A computer simulation model developed by Ting (1980) was used to calculate the daily efficiencies of collectors under different operating conditions. The computer model was verified by Morrison's (1977) experimental data. Using the simulation results, a functional relationship was developed between the daily efficiencies of collectors and their design parameters. (8 refs.)

120767 Visualization of optical and thermal performance of solar components using encapsulated liquid crystals. W.M.Worek (Dept. of Mech. Engng., Illinois Inst. of Technol., Chicago, IL, USA).
Sol. Energy (USA), vol.31, no.6, p.613-15 (1983).
A nonintrusive, diagnostic tool using liquid crystals to indicate design modifications for improving the performance of solar components is described. This technique is demonstrated to study the transmittance of an array of spherical glass tubes used as a flat plate collector cover. (8 refs.)

First World Congress on Desalination and Water Re-Use .... See Entry 116916

Experimental determination of the transference parameters of a nonconvecting solar pond .... See Entry 118358

Study of the phenomena of saline diffusion in a solar pond without convection to control stability .... See Entry 119239

Investigation of copper oxide coatings for solar selective applications .... See Entry 119373

Optimal water cost from solar-powered multieffect distillation .... See Entry 120719

The utilizability function. I. Theoretical development of a new approach .... See Entry 120726

Solar thermal engine systems using two stage concentrators . See Entry 120754

86.30Z Other topics

120768 Five year testing with the Texaco coal gasification plant in Oberhausen-Holten (BRD). J.A.Toebes (N.V. KEMA, Arnhem, Netherlands), P.Ruprecht, R.Durrfeld.
Elektrotechniek (Netherlands), vol.61, no.8, p.582-9 (Aug. 1983). In Dutch.
Since 1978, Ruhrchemie, Ruhrkohle and Texaco have been developing Texaco's Coal Gasification Process. In the course of this 5 year effort the pilot plant in Oberhausen has produced 120 mm Nm^3 of synthetic gas from approximately 70000 metric ton of various coals. This paper presents the most important data about the process, gas, slag and process water environmental data plus technical information. (4 refs.)

86.40 ENERGY STORAGE (SECONDARY ENERGY)

86.40F Storage in thermal energy

120769 Investigations of sodium acetate trihydrate for solar latent heat storage, controlling the melting point. A.Ulman, B.Valentin (Isotope Dept., Weizmann Inst. of Sci., Rehovot, Israel).
Sol. Energy Mater. (Netherlands), vol.9, no.2, p.177-81 (July-Sept. 1983).
The addition of different acetate salts and acetamide lowers the melting point of sodium acetate trihydrate. Between 0-10% of lithium acetate dihydrate a linear relationship was observed between the melting point and the molal concentration, and the cryoscopic constant of $K_f = -6.8°C$ ($\pm 10\%$) was evaluated. Information on dissociation or dimerization of the various additives could be deduced from the results. The positive properties of sodium acetate trihydrate were retained. (10 refs.)

Optimum mass flow rate of water in a flat plate solar collector coupled with a storage tank and an organic Rankine cycle power loop .... See Entry 120757

86.40H Storage in chemical energy

120770 Energy storage using the BaO_2-BaO reaction cycle. M.A.Fahim, J.D.Ford (Chem. Engng. Dept., Univ. of Kuwait, Kuwait, Kuwait).
Chem. Eng. J. (Switzerland), vol.27, no.1, p.21-8 (Aug. 1983).
The reversible reaction of the decomposition of BaO_2 and the subsequent oxidation of BaO was investigated to evaluate the possibility of using the reaction cycle for chemical energy storage. Isothermal and non-isothermal thermogravimetric techniques were used to study the kinetics of this reaction cycle. An activation energy of 33.6 kcal mol^{-1} was estimated for the forward reaction. In contrast, an activation energy of 12.4 kcal mol^{-1} was estimated for the reverse reaction. A marked decrease in the reaction reactivity was observed on repeated cycling. (12 refs.)

Conductive polymers as electrode materials .... See Entry 120644

The technology of the Li/Cl_2 in SO_2Cl_2 cell system. IV. High temperature performance, storability, and safety characteristics .... See Entry 120730

The technology of the Li/BrCl in $SOCl_2$ inorganic battery system: performance and self-discharge characteristics following long-term storage .... See Entry 120731

Simulation of an absorption heat pump solar heating and cooling system .... See Entry 120759

86.40K Hydrogen storage and technology

120771 Hydride storage devices for load levelling in electrical power systems. H.Buchner, E.Schmidt-Ihn, E.Kliem, U.Lang, U.Scheer.
Report EUR 7314 EN, Comm. European Communities, Luxembourg (1983), 135 pp. Contract 602-78-9-EHD.
The use of metal hydrides for the storage of hydrogen is investigated. Technical and economic aspects of using large stationary storage devices for electrical load levelling are discussed. Two storage capacities, 100 MWh (32000 m^3 of H_2) and 1000 MWh (320000 m^3 of H_2) are considered, and the units are based on low-temperature Ti, Cr, Mn hydrides, which can usefully store 2% hydrogen by weight. The thermodynamics, thermal conductivities, and kinetics of the hydrides were investigated and a method of improving their low thermal conductivity, through the addition of a metal powder, was developed. (34 refs.)

120772 Magnesium hydride for load levelling energy storage. B.Vigeholm.
Report EUR 8507 EN, Comm. European Communities, Luxembourg (1983), 108 pp. Contract EHC-14-009-DK.
Some of the magnesium properties essential to the applicability of the reaction $Mg+H_2 \leftrightharpoons MgH_2$ as a hydrogen storage system have been investigated. Three magnesium powders with particle size smaller than 50 μm average diameter were cycled, over 31, 71 and 151 cycles respectively, at 675K (400°C) and at absorption pressures, 2-3 MPa. The powders absorbed and desorbed 60-95% of the theoretically maximal amount of hydrogen given by stoichiometric MgH_2. The reaction rates changed negligibly over the extent of the experiments permitting the mentioned hydrogen exchange to be completed in less than 20 minutes. A high capacity, automatic cycling facility suitable for a more comprehensive investigation of the long term capacity parameters has been constructed and tested but not yet applied. (10 refs.)

86.60 REQUIREMENT FOR ENERGY: ECOLOGICAL ASPECTS

120773 Acid rain: board game to computer simulation. S.J.Rakow, A.D.Glenn, W.E.Fifer (Univ. of Minnesota, Minneapolis, MN, USA).
Simulation & Games (USA), vol.14, no.1, p.29-46 (March 1983).
The Acid Rain computer simulation is designed to help students explore some of the basic relationships involved in the problem. It was developed initially as a board game as a part of the interdisciplinary science/social studies materials written for upper elementary school children. This article describes the development of the overall model. (2 refs.)

86.70 ENVIRONMENTAL SCIENCE

(see also 87.60R Radioactive pollution; for oceanographic aspects, see 92.10; for hydrological aspects see 92.40; for meteorological aspects see 92.60)

SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82 .... See Entry 116913

Tobermorites: a new family of cation exchangers .... See Entry 121236

86.70C Soil

Estimation of multicomponent breakthrough curves in soil environment .... See Entry 117609

Heat transfer behavior of frozen soils .... See Entry 118362

Aluminium chemistry and acidification processes in a shallow podzol on the Swedish westcoast .... See Entry 121302

86.70E Water

120774 Relationship between pelagic tar, fluorescence and biological markers in the South Atlantic Ocean. M.C.Kennicutt,II, J.M.Brooks (Dept. of Oceanography, Texas A&M Univ., College Station, TX, USA).
Mar. Pollut. Bull. (GB), vol.14, no.9, p.335-42 (Sept. 1983).
Surface pelagic tar concentrations in the equatorial South Atlantic Ocean were low (<0.001 to 14.6 mg m^{-2}). The tars were characterized by gravimetry, carbon isotopic composition, molecular compositions (gas chromatographically), sulphur content, total fluorescence spectra, and biological marker fingerprints. A total fluorescence technique was used to group the tars into two basic types. One type occurred at low concentrations and appeared to be due to chronic long-term oil pollution in the South Atlantic Ocean. The second group occurred at much higher concentrations and was associated with more coastal-influenced waters. Carbon isotopic composition and pristane/phytane ratios exhibited few geographical trends. (21 refs.)

120775 Dumping of radioactive wastes at sea. L.A.Konig (Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Germany).
Naturwissenschaften (Germany), vol.70, no.9, p.430-3 (Sept. 1983). In German.
The author gives an introduction to the problems of dumping at sea of radioactive wastes. A short survey is given on the dumping actions previously performed, the legal justification by international treaties, and the most important radioecological questions. (23 refs.)

Determination near the limit of detection with a sequential scanning inductively coupled plasma emission spectrometer .... See Entry 117237

Effect of localized waste-container failure on radionuclide transport from an underground nuclear waste vault .... See Entry 117620

Diffusional mass transport phenomena in the buffer material and damaged zone of a borehole wall in an underground nuclear waste vault ..... See Entry 117621

High-level waste glass field burial tests at CRNL: The effect of geochemical kinetics on the release and migration of fission products in a sandy aquifer .... See Entry 117622

Determination of total cyanide in thiocyanate-containing wastewaters .... See Entry 120686

Comparative studies of radionuclides from global fallout and local sources in ground level air and sewage sludge .... See Entry 120792

Crater Lake revisited: concentration changes in water column radionuclides, 1967 to 1981 .... See Entry 121297

Restoration of Norwegian lakes by reduction in sulphur deposition .... See Entry 121299

Ground water contamination in the United States .... See Entry 121301

Proceedings of the 26th Conference on Great Lakes Research (papers in summary form only received) .... See Entry 121378

The instrument for the determination of dissolved oxygen in seawater .... See Entry 121410

86.70G Atmosphere

120776 An integral model for gravity spreading of heavy gas clouds. S.Byggstoyl (Inst. of Thermodynamics, NTH, Trondheim, Norway), L.R.Saetran.
Atmos. Environ. (GB), vol.17, no.9, p.1615-20 (1983).
An integral model for instantaneous release of heavy gas clouds in a calm environment is developed. The predicted frontal velocity differs from the gravity head expression assumed by other models in that it contains additional terms dependent upon both the cloud profile, cloud density, ground friction and air entrainment. The model is tested against experimental results and the agreement is satisfactory. A comparison with other models is also given. (10 refs.)

120777 Sea-breeze circulation and photochemical pollution in Athens, Greece. D.P.Lalas, D.N.Asimakopoulos, D.G.Deligiorgi (Dept. of Meteorology, Univ. of Athens, Athens, Greece), C.G.Helmis.
Atmos. Environ. (GB), vol.17, no.9, p.1621-32 (1983).
Analyses the effect of the sea-breeze on photochemical pollution in Athens, Greece. To this end, the SO_2, NO, NO_2, O_3 and CO concentrations, the vertical structure of the atmospheric boundary layer, the pollution emission rates and wind data are examined simultaneously for two typical days in August 1981 with well-defined sea-breeze circulation. The tendency of the complicated sea-breeze flow field to stratify the atmosphere and thus generate layers with different constituents affects the concentrations measured near the ground and causes relatively high oxidant levels at night. As inversion layers descend or disappear, abrupt changes and short-period oscillations in concentrations are found, and can be explained by a simple multilayer box model. (22 refs.)

120778 Characterization of the transport and dispersion of pollutants in a narrow mountain valley region by means of an atmospheric tracer. R.Willson, F.Shair (Chem. Engng., California Inst. of Technol., Pasadena, CA, USA), B.Reynolds, W.Greene.
Atmos. Environ. (GB), vol.17, no.9, p.1633-47 (1983).
Three atmospheric tracer experiments using sulfur hexafluoride (SF6), were conducted in a narrow mountain valley from 29 January-3 February 1982. These tests were performed in order to characterize the transport and dispersion of airborne pollutants around Telluride, Colorado which lies near the head of the San Miguel Valley. Particular attention was given to the influence of flow reversals upon pollutant dispersion, for which adequate numerical simulation is not yet available. Data from surface wind stations, pilot balloons and from an acoustic sounder were used to characterize the local meteorology. In this case, an upslope flow followed by a downslope drainage is required for emissions from a site on the slope to reach the upper valley about 10 km away. On the other hand, a downvalley flow followed by an upslope flow is required for emissions from the upper valley to reach the slope site. (11 refs.)

120779 Forecasting peak ozone levels. R.W.Simpson (School of Australian Environmental Studies, Griffith Univ., Nathan, Queensland, Australia), A.P.Layton.
Atmos. Environ. (GB), vol.17, no.9, p.1649-54 (1983).
Box-Jenkins (1970) time series models are used to predict peak afternoon O_3 levels. Data sets from three monitoring stations in Brisbane, Queensland, Australia, are used in the analysis, one of the stations being inner-city and the others being outer-city. It is found that univariate models using only the peak O_3 data-set at a site to predict future peak O_3 levels are unsatisfactory. However bivariate models using peak O_3 data from one site to predict peak O_3 levels at another site yield good results. However it is clear that these results only arise because the O_3 is formed in a well mixed layer over the region leading to a high degree of correlation between O_3 peaks throughout the region. (15 refs.)

120780 On the treatment of point source emissions in urban air quality modeling. C.Seigneur, T.W.Tesche, P.M.Roth, Mei-Kao Liu (Systems Applications Inc., San Rafael, CA, USA).
Atmos. Environ. (GB), vol.17, no.9, p.1655-76 (1983).
Presents the development and evaluation of an urban air quality model, the Plume-Airshed Reactive-Interacting System (PARIS), that is capable of providing a detailed treatment of large point source emissions. The PARIS model treats these large point sources by embedding one or more reactive plume models into the Systems Applications urban airshed model, which is a three-dimensional gridded model governed by the atmospheric diffusion equation. These embedded reactive plume models are used to describe the chemistry and dynamics of large point source plumes and their interaction with the ambient urban environment. For purposes of evaluation and comparison, the Systems Applications urban airshed model and the PARIS model were applied to the St. Louis urban area for a one-day simulation and to the South Coast Air Basin (Los Angeles area) for a two-day simulation. (31 refs.)

120781 Comparing the calculated and measured aerosol concentrations and depositions around a metallurgical plant. B.Vanderborght, I.Mertens, J.Kretzschmar (Nuclear Engng. Res. Center, SCK/CEN, Mol, Belgium).
Atmos. Environ. (GB), vol.17, no.9, p.1687-701 (1983).
The aerosol concentration and deposition around a metallurgical plant are analysed. Measurements were carried out continuously over 14 months in order to obtain reliable data on the emissions, the local meteorological conditions and the ambient aerosol concentration and deposition levels. A bi-Gaussian dispersion model with source depletion is used for the simulation of the aerosol concentration and deposition. The dominating role of the fugitive compared with stack emissions was emphasized and the inevitable inaccuracies in the simulation of these sources is demonstrated. The fall-out velocity for the ISO deposit gauge was experimentally determined and interpreted. (20 refs.)

120782 Aircraft observations of regional transport of ozone in the northeastern United States. J.F.Clarke, J.K.S.Ching (Environmental Sci. Res. Lab., US Environmental Protection Agency Res., Triangle Park, NC, USA).
Atmos. Environ. (GB), vol.17, no.9, p.1703-12 (1983).
A regional-scale aircraft sampling program was conducted during August 1979 to obtain data for validation of a regional-scale photochemical air quality simulation model and for studying the physical and chemical processes important in long-range transport of O_3 and O_3 precursors throughout the diurnal cycle. Three aircraft were deployed in a Lagrangian sampling mode to obtain continuous measurements of O_3, oxides of nitrogen, nephelometer scattering coefficient, and grab samples to be analyzed later for hydrocarbon species. The analysis reported is for a 24 h period during which relatively

high O_3 concentrations, generated within urban plumes, were transported from Ohio to the NE Corridor. (11 refs.)

120783 Measurements of benzene, toluene and xylenes in urban air. B.M.Wathne (Norwegian Inst. for Air Res., Lillestrom, Norway).
Atmos. Environ. (GB), vol.17, no.9, p.1713-22 (1983).
Results from measurements of benzene, toluene and xylenes in the city centre of Oslo are presented. The samples were collected in March and August/September 1980 at two of the stations used in an air pollution monitoring program. One was in a street canyon station and the other was a reference station. The sampling equipment was two charcoal filters in series, placed in a filter holder with a disk of glass fibre prefilter in front. Analysis was by high resolution gas chromatography. (13 refs.)

120784 In-situ, rapid response measurement of $H_2SO_4/(NH_4)_2SO_4$ aerosols in urban Houston: a comparison with rural Virginia. A.P.Waggoner, R.E.Weiss, T.V.Larson (Dept. of Civil Engng., Univ. of Washington, Seattle, WA, USA).
Atmos. Environ. (GB), vol.17, no.9, p.1723-31 (1983).
Reports measurements taken in Houston, Texas of the chemical composition and degree of hydration of haze particles and compares these results with previously reported measurements taken in rural Virginia. The in-situ, real time measurements are based on detecting changes in particle light scattering extinction with changes in relative humidity and air temperature. With these methods one can determine fine particle mass and sulfate mass concentrations, and sulfate to ammonium ion molar ratio. (11 refs.)

120785 Size-differentiated composition of inorganic atmospheric aerosols of both marine and polluted continental origin. R.M.Harrison, C.A.Pio (Dept. of Environmental Sci., Univ. of Lancaster, Lancaster, England).
Atmos. Environ. (GB), vol.17, no.9, p.1733-8 (1983).
Atmospheric aerosols were sampled with a high volume impactor/diffusion battery system and the collected fractions analysed for their major water-soluble inorganic constituents. Sulphate, nitrate and chloride showed bimodal distributions; sulphate and nitrate were mainly associated with NH_4^+, having approximately log-normal distributions with modes at 1.0 μm. In unpolluted maritime air, chlorides appeared as salts of sodium and magnesium with average modes at *c.* 5 μm, whilst in polluted air masses significant concentrations of ammonium chloride sub-μm aerosols were detected. Sodium nitrate and sodium sulphate aerosols having average modes of *c.* 3.5 μm were observed in mixed maritime/polluted air masses. The dimensions of these particles indicate formation from absorption of H_2SO_4 and HNO_3 at the surface of marine NaCl particles. (15 refs.)

120786 Gas-to-particle conversion of sulfur in power plant plumes. II. Observations of liquid-phase conversions. N.V.Gillani (Washington Univ., St. Louis, MO, USA), W.E.Wilson.
Atmos. Environ. (GB), vol.17, no.9, p.1739-52 (1983).
For pt.I see ibid., vol.15, p.2293-313 (1981). The data from 5 days plume measurements under wet conditions are presented for the transport of the Labadie plume (St. Louis, Missouri) and the Cumberland and Johnsonville plumes (Tennessee). Collectively, the data include instances of liquid-phase reactions in wetted aerosols, as well as in rain, cloud and fog droplets. Detailed case studies are presented for two days of the Tennessee measurements when considerable plume-cloud interactions occurred, and on one of these days, the plumes were also sampled in light rain conditions. (16 refs.)

120787 Gas-to-particle conversion of sulfur in power plant plumes. III. Parameterization of plume-cloud interactions. N.V.Gillani, J.A.Colby (Washington Univ., St. Louis, MO, USA).
Atmos. Environ. (GB), vol.17, no.9, p.1753-63 (1983).
Long-range plume transport-transformation models generally require bulk rates of chemical transformations averaged over plume segments whose spatial-temporal scales exceed those of most clouds. There arises, therefore, the need to average out over the entire plume segment the effect of processes occurring quite rapidly in random and discrete clouds which occupy only parts of the segment. An attempt is made to quantify the relationship between the fast in-cloud sulfate formation rate (K_t) and the slower bulk sulfate formation rate by liquid phase mechanisms in an entire plume segment (k_i). The ratio k_t/K_t is interpreted statistically. A quantitative expression is derived relating this plume-cloud interaction function to plume dimensions and to specific cloud-related quantities. A short-term and a long-term application of this plume-cloud interaction parameterization are attempted. (23 refs.)

120788 Visibility-pollutant relationships in southern Arizona. II. A winter/summer field study. W.P.Linak, T.W.Peterson (Dept. of Chem. Engng., Univ. of Arizona, Tucson, AZ, USA).
Atmos. Environ. (GB), vol.17, no.9, p.1811-23 (1983).
For pt.I see ibid., vol.15, p.2421-32 (1981). Previous analysis of historical air quality data for the southern Arizona region (Linak and Peterson, 1981) suggested that sulfur containing aerosol species have a significant impact on local visibility. A field monitoring program was therefore undertaken to further characterize the particle size and chemical distribution of atmospheric aerosols in the area. Measurements of various gaseous pollutants, meteorological conditions and light-scattering coefficient were also included. Separate studies during winter and summer months were made to discern seasonal changes in aerosol behavior. In addition to detailed analysis of data for selected days, statistical analysis of the entire data set is performed. It is found that, while localized visibility correlate best with large-particle aerosol volume, regional haze is most affected by small-particle (sub μm) aerosol volume. (22 refs.)

120789 Statistical model applicable to contamination from a point source. M.Luisa Sanchez, F.Nieto, J.L.Sanchez, M.C.Ramos (Facultad de Ciencias, Univ. de Valladolid, Spain).
An. Fis. Ser. B (Spain), vol.79, no.2, p.158-63 (May-Aug. 1983). In Spanish. [received: Oct. 1983]
The authors have studied the statistical distribution of the wind speed and concentrations of particulate, gaseous, and total fluorides, measured in 8 monitoring stations placed on the sector NE to NNE, in the neighbourhood of an aluminium factory. It was located at the town of Valladolid. After obtaining the statistical distribution in each monitoring station, they have stabilised an empirical statistical model, able to predict the particulate, gaseous and total fluorides concentrations in any meteorological conditions. The model was tested with satisfactory results, using the data obtained on a monitoring station placed on a NNW sector. (13 refs.)

120790 Complex I and II model performance evaluation in Nevada and New Mexico. P.D.Gutfreund (Systems Applications Inc., San Rafael, CA, USA), C.S.Liu, B.R.Nicholson, E.M.Roberts.
J. Air Pollut. Control Assoc. (USA), vol.33, no.9, p.864-71 (Sept. 1983).
The COMPLEX I and COMPLEX II Gaussian dispersion models for complex terrain applications have been made available by EPA. A model performance evaluation exercise involving three of the available options with both COMPLEX models was carried out using SF_6 tracer measurements taken during worst-case stable impaction conditions in complex terrain in southern Nevada. The models did not reproduce observed concentrations on an event by event basis, as correlation coefficients for 1-h concentrations of 0-0.3 were exhibited. When observed and calculated cumulative frequency distributions for 1-h and 3-h concentrations were compared, a close correspondence between observations and concentrations calculated with COMPLEX I, ,IOPT(25)=2 or 3 was noted. (15 refs.)

120791 A surface-corrected Gaussian model for elevated sources. T.J.Overcamp (Environmental Systems Engng., Clemson Univ., Clemson, SC, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.1111-15 (June 1983).
A Gaussian model for continuous elevated sources is developed which uses a continuous distribution of ground-level sources to replace the use of the image source. For the case of Fickian diffusion with uniform wind, this model is mathematically identical to the conventional Gaussian model with the image source, and therefore, provides a more physically realistic model to justify the use of the image source. For the general, non-Fickian case, the predictions of the surface-corrected model and the conventional model differ. (9 refs.)

120792 Comparative studies of radionuclides from global fallout and local sources in ground level air and sewage sludge. B.Erlandsson, T.Ingemansson (Dept. of Nuclear Phys., Univ. of Lund, Lund, Sweden), S.Mattsson.
Water, Air & Soil Pollut. (Netherlands), vol.20, no.3, p.331-46 (Oct. 1983).
The presence of activation products in the environment released into the air from a nuclear power station is studied in sewage sludge and ground level air. The measured time variation of the ^{60}Co concentration in sludge and ground level air is found to be in good agreement with the reported variation in release rate to the air from the power station when the prevalent wind direction is taken into account. The ratio between the ^7Be normalized concentration in sludge and ground level air is studied and is found to be about 1 for radionuclides due to global fallout but less than 2×10^{-3} for ^{60}Co. The conclusion is that ^{60}Co spreads from a local source (a nuclear power station) and to a considerable degree is dry deposited on the ground and then washed off by rain. (12 refs.)

Experimental study of charcoal adsorptive technique for measurement of radon in air ....See Entry 117738

Acid rain: board game to computer simulation ....See Entry 120773

Sampling of carbonaceous particles in the atmosphere ....See Entry 120794

Use of the α spectrometer to simultaneously measure the equilibrium of atmospheric daughters of Rn and Tn ....See Entry 120795

Electron-energy absorption used for the measurement of superficial densities of air-pollution samples on thin membrane filters ....See Entry 120796

Restoration of Norwegian lakes by reduction in sulphur deposition ....See Entry 121299

Acetonitrile in the atmosphere ....See Entry 121333

The ozone budget in the stratosphere: results of a one-dimensional photochemical model ....See Entry 121341

Ozone varability ....See Entry 121342

Atmospheric composition: influence of biology ....See Entry 121343

Influence of peroxyacetyl nitrate (PAN) on odd nitrogen in the troposphere and lower stratosphere ....See Entry 121344

***N*-nitroso compounds: evidence for their presence in airborne particles** ....See Entry 121351

86.70J Noise

(see also 43.50 Noise, its effects and control)

120793 Long term sleep disturbance due to traffic noise. M.Vallet, J.-M.Gagneaux, V.Blanchet, B.Favre, G.Labiale (Inst. de Recherche de Transports, Bron, France).
J. Sound & Vib. (GB), vol.90, no.2, p.173-91 (22 Sept. 1983).
This contribution to the evaluation of the effects of traffic noise on sleep disturbance is focused on the responses of people living near a main road. Experiments were carried out in the homes of subjects who had habitually been exposed to noise for periods of more than four years. The chronic changes in overall sleep patterns and the temporary sleep responses to particular noise events caused by traffic are demonstrated. Young people show mainly stage 3 and 4 deficits whilst older people show REM sleep deficits. The cardiac response to noise during sleep was also examined. These results highlight that both long term average and peak levels are important in assessing sleep disturbance. The threshold levels, measured inside the bedroom and above which sleep quality starts to become impaired, are 37 $L_{eq}(A)$ and 45 dB(A)$L_{p\ max}$, respectively. For the type of traffic studied these two levels are coherent and it is therefore possible that a single noise index $L_{eq}(A)$, is sufficient to scale sleep disturbance. (26 refs.)

A dynamical estimation method of environmental noise system based on the quantized level measurement contaminated by the background noise ....See Entry 120797

86.70L Measurement techniques in environmental science

120794 Sampling of carbonaceous particles in the atmosphere. B.R.Appel, Y.Tokiwa, E.L.Kothny (Air & Industrial Hygiene Lab., California Dept. of Health Services, Berkeley, CA, USA).
Atmos. Environ. (GB), vol.17, no.9, p.1787-96 (1983).
A method for measurement of atmospheric carbonaceous particulate matter is proposed and evaluated. A diffusion denuder, placed ahead of a filter, is used to exclude vapor-phase organic compounds which might be retained by adsorption on the filter. The carbonaceous material lost by volatilization from the filter after collection is retained with a fluidized bed of powdered Al_2O_3. The efficiencies of the denuder and Al_2O_3 are evaluated with vapor phase phenanthrene and octadecane. Atmospheric sampling was done at two urban and one background site in California using the proposed technique in parallel with conventional hi-vol and dichotomous samplers. (25 refs.)

120795 Use of the α spectrometer to simultaneously measure the equilibrium of atmospheric daughters of Rn and Tn. J.Gonzalez Suarez, F.Castro Del Val, Roque.Casanova,J.L. (Facultad de Ciencias, Univ. de Valladolid, Valladolid, Spain).
An. Fis. Ser. B (Spain), vol.79, no.2, p.152-7 (May-Aug. 1983). In Spanish. [received: Oct. 1983]
A technique for the simultaneous measurement of the degree of radioactive equilibrium between the atmospheric short-lived radon-222 daughters and the corresponding thoron (radon-220) daughters through the individualized measurement of the concentrations of these elements by α-spectrometry is described. (13 refs.)

120796 Electron-energy absorption used for the measurement of superficial densities of air-pollution samples on thin membrane filters. B.Denecke (Commission of the European Communities, Central Bur. for Nuclear Measurements, Geel, Belgium).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1311-22 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
A sampling and analysis method to measure dust concentrations in air is described. The dust was deposited on membrane filters, the superficial density of which was measured by an electron-energy-absorption method. Internal-conversion electrons from the ^{109}Cd decay were used as the electron source. The electron detector was a gas-proportional counter operated at atmospheric pressure with a 90% Ar+10% CH_4 gas flow. Detected superficial-density differences ranged from 0 to 400μg/cm^2 with an estimated accuracy of 20μg/cm^2. The measurement process was automated using a computer-controlled sample changer. About 8000 samples were taken and analysed during 18 months. In addition to the total amount of dust the blackening index of the dust stains was also measured by an optical reflection method. (15 refs.)

120797 A dynamical estimation method of environmental noise system based on the quantized level measurement contaminated by the background noise. M.Ohta, K.Hatakeyama (Faculty of Engng., Hiroshima Univ., Higashi-Hiroshima, Japan).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.777-84
The authors have attempted to establish a unified methodology for removing the undesirable effects of the background noise and the quantization errors of digital measuring apparatus, on the estimates of unknown random signals in the actual noise environment, through some improvement of the Bayes theorem. The validity and the effectiveness of the proposed estimation method are experimentally confirmed by applying it to the actually observed data of room acoustics. (4 refs.)

10th Annual Conference of the Association for Aerosol Research (Gesellschaft fur Aerosolforschung) .... See Entry 116920

Estimation of multicomponent breakthrough curves in soil environment .... See Entry 117609

Experimental study of charcoal adsorptive technique for measurement of radon in air .... See Entry 117738

The heavy atom effect in the room temperature luminescence of some pesticides and ecologically related compounds .... See Entry 117911

Determination of total cyanide in thiocyanate-containing wastewaters .... See Entry 120686

Complex I and II model performance evaluation in Nevada and New Mexico .... See Entry 120790

The instrument for the determination of dissolved oxygen in seawater .... See Entry 121410

Application of the atomic Voigt effect for the determination of the trace elements (Ag, Pb, Rb) .... See Entry 121411

86.70Z Other topics

Comparative studies of radionuclides from global fallout and local sources in ground level air and sewage sludge .... See Entry 120792

87.00 BIOPHYSICS, MEDICAL PHYSICS, AND BIOMEDICAL ENGINEERING

87.10 GENERAL, THEORETICAL, AND MATHEMATICAL BIOPHYSICS

(inc. logic of biosystems, quantum biology, and relevant aspects of thermodynamics, information theory, cybernetics, and bionics)

120798 The reverberator in an active medium. Analytical results. A.S.Mikhailov, V.I.Krinskii (Inst. of Biological Phys., Acad. of Sci., Pushchino, USSR).
Biophysics (GB), vol.27, no.5, p.919-25 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.5, p.875-9 (1982). [received: Sept. 1983]
An approximate analytical method is outlined for calculating a rotating helical wave in an active medium based on transition to a system of coordinates linked with the wave front. An equation is derived for the helical wave and a method is devised for setting the boundary conditions for solving this equation. As an illustration of the Rinzel-Keller model the dependence of the wave frequency and wavelength of the reverberator and helical wave rotating about the aperture on the parameters of the medium are considered. (12 refs.)

120799 Numerical study of the stochastic behaviour of a simple biological system. V.V.Alekseyev, A.N.Kornilovskii (Phys. Faculty, Lomonosov State Univ., Moscow, USSR).
Biophysics (GB), vol.27, no.5, p.935-9 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.5, p.890-4 (1982). [received: Sept. 1983]
A set of differential equations modelling the dynamics of metabolism is studied. The presence in phasic space of a strange attractor suggests that stochastic behavior is a common phenomenon in biophysics. It is shown that the size of the attractor determines the sensitivity threshold of the system for each of the dynamic variables. (9 refs.)

120800 Physical chemistry and respiratory control—a mathematical model. J.Silverberg (Boston Univ., Boston, MA, USA), P.Stewart, R.Hopkins.
Electro/82 Conference Record, Boston, MA, USA, 25-27 May 1982 (El Segundo, CA, USA: Electron. Conventions 1982), p.15-4/1-10
This model explores the interactions between the 'chemical' system and the 'physiological' system. In the respiratory control model formed by the inclusion of both these systems, the determinants of the ventilatory rate, as well as the events which arise from the consequences of that ventilatory rate are both calculated from a firm theoretical base. The model presented combines more detailed solution chemistry and thermodynamics with traditional physiological information concerning capillary function and carbon-dioxide aspects of respiratory control. It satisfactorily predicts the electrolyte, acid-base, and CO_2-related behavior of the respiratory system, including details of the specific compositions of arterial and venous plasma and red cells, as well as normal ventilatory parameters. (31 refs.)

Acid rain: board game to computer simulation .... See Entry 120773

Model simulation of heat and water transport dynamics in an airway .... See Entry 120815

Parametric estimation of ventilation-perfusion ratio distributions .... See Entry 120881

Finite element modelling of lungs including interlobar fissures and the heart cavity .... See Entry 120914

Comparative evaluation of techniques for the harmonic analysis of human motion data .... See Entry 120921

Acoustic modeling of lung dynamics using Bond graphs .... See Entry 120935

87.15 MOLECULAR BIOPHYSICS

(see also 36.20 Macromolecules and polymer molecules)

120801 Hydrophobic moments and protein structure. D.Eisenberg, R.M.Weiss, T.C.Terwilliger, W.Wilcox (Dept. of Chem., Univ. of California, Los Angeles, CA, USA).
Faraday Symp. Chem. Soc. (GB), no.17, p.109-20 (1982). [received: Sept. 1983] (Symposium on the Hydrophobic Interaction, Reading, Berks., England, 15-16 Dec. 1982).
The structure of a protein can be analysed in terms of what may be called the 'hydrophobic moments' of (1) the entire molecule and (2) of the segments of secondary structure that make up the polypeptide chain. The zeroth moment is defined as the sum of the hydrophobicities of the amino-acid residues of the structure under consideration; it is the analogue of the net charge of a cluster of point charges. The first moment, or hydrophobic dipole moment, is the analogue of the electric dipole moment of a cluster of charges. Just as the electric moment measures the asymmetry of the charge distribution, the hydrophobic dipole moment measures the amphiphilicity (asymmetry of hydrophobicity) of the structure. A large hydrophobic dipole moment indicates that a structure is predominantly hydrophobic on one side and predominantly hydrophilic on the other. A quadrupole hydrophobic moment may be similarly defined. It indicates whether a protein is more hydrophobic in its interior (as for a globular protein in aqueous solution) or at its surface (as for a membrane protein). The authors examine the hydrophobic dipole moments in the known structures of nine globular proteins and find that the moments of neighbouring segments tend to point towards each other. This suggests that the hydrophobic dipole can serve as a simple and pictorial summary of some of the forces at work in the folding of proteins. They have also found that the interactions of some macromolecules with an apolar-polar interface can be conveniently described in terms of the hydrophobic moments of the molecule and a 'hydrophobic field' which reflects the hydrophobicity of the environment. (21 refs.)

120802 Dynamics of native globular proteins in terms of dihedral angles. T.Noguti, N.Go (Dept. of Phys., Kyushu Univ., Fukuoka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3283-8 (Sept. 1983).
Problems are discussed that are associated with extension of the time-independent method of conformational energy analysis of biopolymers, in which only dihedral angles are treated as independent variables, to time dependent one. For molecules with small amplitudes of fluctuations, internal motions of atoms due to variations of dihedral angles are shown to be defined with respect to a coordinate system which is defined by the Eckart's condition and is moving with the molecule. Computationally efficient and explicit expressions are given (i) for a coefficient matrix to convert small changes in dihedral angles to small atomic displacements from the mean positions, and (ii) for a coefficient matrix in the expression of the kinetic energy of internal motions in terms of first order time derivatives of variable dihedral angles.

120803 Spin-one lattice gas model for isotherm-reversal in spin-labelled lipid monolayers. K.G.Chakraborty, J.F.Baret (Dept. de Phys. des Liquides, Univ. de Provence, Marseille, France).
Phys. Status Solidi b (Germany), vol.119, no.1, p.61-71 (1 Sept. 1983).
A suitably extended version of a spin-one lattice gas model, embodying the basic ideas of Cadenhead and Muller-Landau (1974, 1975) and Bell and Dunne (1978) is employed to study the 'isotherm reversal' appearing in the pressure-area phase diagram of spin-labelled monolayers. Considering the nine different configurations of molecules as conceived by Bell and Dunne the Hamiltonian is developed and the molecular field approximation is applied to derive the expression for pressure. The phase diagrams are drawn for various values of the model parameters and it is seen that the isotherm-reversal is a characteristic of the model itself. Unlike the one-dimensional model of Bell and Dunne, the present model shows the phase transition from a liquid-expanded to a liquid-condensed phase. (10 refs.)

Electron transfer in proteins .... See Entry 117983

87.15B Structure, configuration, conformation, and active sites at the biomolecular level

120804 Thermal instability in lamellar phases of lecithin: a planar undulation model. A.G.Petrov (Inst. of Solid State Phys., Acad. of Sci., Sofia, Bulgaria), G.Durand.
J. Phys. Lett. (France), vol.44, no.18, p.L793-8 (15 Sept. 1983).
Under heating, a hydrated egg lecithin multilamellar sample in a planar geometry (lamellae normal to the plate) shows a periodic striation instability, followed at higher heating by the so-called 'ear-like' domains. The authors first demonstrate that a normal lamellae contraction under heating can result into a lamellar undulation instability in a planar sample, as well as in a homeotropic geometry. Assuming a strong anchoring of the lamellae on the plates, with the force free condition on the lamellae outer surface, the undulations are localized close to the plates. The spatial period and the threshold are estimated. Observations of hydrated DLL samples of various thicknesses allow them to identify the periodic striations with this localized undulation instability. (7 refs.)

120805 Effect of high pressure on a lipid non-bilayer phase. E.L.Chang, P.Yager (Naval Res. Lab., Washington, DC, USA).
Mol. Cryst. & Liq. Cryst. (GB), vol.98, no.1-4, p.125-9 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The authors have developed a new optical method to monitor the lamellar to hexagonal$_{II}$ phase transition of lipids under high pressure. This method depends on the changes in the transmittance property of a pelleted sample inside a windowed pressure cell. The pelleted sample is opaque to a focused He-Ne laser beam below the phase transition whereas the compacted lipid becomes translucent above the phase transition temperature. The change in transmitted light intensity is about an order of magnitude and allows them to identify the onset of the phase transition to within 0.1°C. They have found a large hysteresis in the heating and cooling scans of egg phosphatidylethanol-

amine that is independent of the rate of scan. In addition, pressure increases the phase transition temperature of the lamellar to hexagonal$\mathrm{I_I}$ phase indicating that the hexagonal$\mathrm{I_I}$ phase is destabilized with respect to the lamellar phase under pressure. (4 refs.)

120806 Orientation of the primary donor in single crystals of Rhodopseudomonas viridis reaction centres. P.Gast, M.R.Wasielewski, M.Schiffer, J.R.Norris (Chem. Div., Argonne Nat. Lab., Argonne, IL, USA).
Nature (GB), vol.305, no.5933, p.451-2 (29 Sept. 1983).
Reports the electron paramagnetic resonance (EPR) spectra of the photochemically derived triplet state of the primary donor of R. viridis in a single reaction-centre crystal as a function of crystal orientation in the magnetic field. Analysis of these spectra allows the authors to assign the orientation of the triplet-state axis system of the primary donor relative to the crystal axis system. (8 refs.)

120807 Mutations and the conformational stability of globular proteins. M.G.Grutter (Univ. Basel, Basel, Switzerland), R.B.Hawkes.
Naturwissenschaften (Germany), vol.70, no.9, p.434-8 (Sept. 1983).
The elucidation of the three-dimensional structure of now over 100 proteins provides the basis for describing the nature of interactions stabilizing native protein structure. To understand the forces responsible for maintaining the native structure, it is necessary to analyze the contributions of the specific forces like a hydrogen bond, a salt bridge or a hydrophobic interaction to the overall stability of a protein. Using mutant proteins carrying a single amino acid substitution, specific interactions in a protein can be altered and the effect can be studied. The results of such studies on stability variants of human haemoglobin and of T4 phage lysozyme are described. (25 refs.)

Computer-assisted studies of hypolipidemic drugs .... See Entry 117782

Study of hydrogen bonds in carbohydrates from the fine structure of the ν(OH) band .... See Entry 117872

Hydrogen bond length and ^{1}H NMR chemical shifts in proteins .... See Entry 118017

Topological solitons and modulated structure of bases in DNA double helices: a dynamic plane base-rotator model .... See Entry 118024

Hydrophobic moments and protein structure .... See Entry 120801

Spin-one lattice gas model for isotherm-reversal in spin-labelled lipid monolayers .... See Entry 120803

87.15M Interactions with radiations at the biomolecular level

120808 S_1 absorption of chlorophyll-a in the red region. D.Leupol (Central Inst. of Optics & Spectroscopy, Acad. of Sci., Berlin, Germany), J.Ehlert, S.Oberlander, B.Wiesner.
Chem. Phys. Lett. (Netherlands), vol.100, no.4, p.345-50 (16 Sept. 1983).
To clear up controversial results of excited-singlet (S_1) absorption of monomeric chlorophyll-a solutions in the red spectral range, non-linear absorption measurements were performed at $\lambda=670$ and evaluated in analytic and numerical terms. A large S_1 absorption cross section has been confirmed at 670 nm $(\sigma_{S1}(670))=0.71\sigma_{S0}(670)$ and excited-singlet absorption underlined as the cause of the anomalous short-wave emission of the Chl-a laser. The S_1 absorption cross sections for Chl-a/dioxan in the range 800-870 nm are given. (16 refs.)

120809 Application of proton NMR spectral editing techniques for selective observation of N-H protons in an actinomycin D complex with a tetranucleotide duplex. D.G.Reid, D.M.Doddrell, K.R.Fox, S.A.Salisbury, D.A.Williams (Univ. of Chem. Lab., Univ. of Cambridge, Cambridge, England).
J. Am. Chem. Soc. (USA), vol.105, no.18, p.5945-6 (7 Sept. 1983).
The complexity of many biological molecules can make proton NMR spectral assignment a challenging task. This task would be facilitated by any technique allowing selective observation of a certain type of resonance. Such a technique is potentially furnished by editing methods that permit exclusive observation of protons directly bonded to a spin-$^1/_2$ nucleus. If this nucleus can be introduced into a molecule selectively, the scope of the method is considerably increased. The assignment of N-H protons is of particular importance considering their role in the stabilization of protein and nucleic acid secondary structure. Two factors can complicate such assignments, analog to digital conversion limitations accompanying the necessity of working in H_2O, and possible overlap with other signals, especially in the aromatic region. The ready availability of many antibiotics biosynthetically enriched in ^{15}N provides the possibility of using editing techniques for spectral simplification in complexes of these antibiotics with suitable receptors. Uniformly enriched actinomycin D^- may be prepared from Streptomyces parvulus grown on a medium containing $Na^{15}NO_3$ as the sole nitrogen source. The complex formed between the drug and the duplex of the self-complementary tetranucleoside triphosphate d(A-G-C-T) is in slow exchange on the ^{1}H NMR time scale below 30°C. NMR spectra were acquired on a Bruker WH-400 modified to pulse protons and 15N simultaneously and observe protons. (7 refs.)

120810 Charged amino acids as spectroscopic determinants for chlorophyll in vivo. J.Eccles, B.Honig (Dept. of Biochem., Columbia Univ., New York, NY, USA).
Proc. Natl. Acad. Sci. USA, vol.80, no.16, p.4959-62 (Aug. 1983).
Proposes that the large spectroscopic red shifts observed for chlorophyll (Chl) and bacteriochlorophyll (BChl) in vivo may be due to charged amino acids in the binding site. Molecular orbital calculations of the transition energies of Chl in the field of external charges are carried out. The calculated wavelength shifts induced by these charges are comparable in magnitude to those observed in vivo. Moreover the size of the shifts increases in the order BChl b>BChla>Chla, which is the observed trend. The ability of the calculations to account for both the absolute and relative magnitudes of the wavelength shifts argues for the validity of the model. Further indirect support comes from the recent demonstration that charged amino acids are responsible for the colors of visual pigments and bacteriorhodopsin. In addition to their effects on spectra the presence of external charges induces large changes in the ionization potential of Chl molecules and thus might explain the in vivo alteration of the oxidation potentials in reaction centers. (35 refs.)

Picosecond fluorescence relaxation kinetics from all-trans retinal .... See Entry 117906

Hydrogen bond length and ^{1}H NMR chemical shifts in proteins .... See Entry 118017

Orientation of the primary donor in single crystals of Rhodopseudomonas viridis reaction centres .... See Entry 120806

87.16 BIOTHERMICS

120811 Relationship between sensory nerve conduction and temperature of the hand. J.Koczocik-Przedpelska, S.Gorski, E.Powierza (Dept. of Pathophysiology of Locomotor Organs, Inst. of Orthopaedic Surgery & Rehabilitation, School of Medicine, Poznan, Poland).
Acta Physiol. Pol. (Poland), vol.34, no.1, p.21-8 (Jan.-Feb. 1983). [received: Sept. 1983]
Electroneurographic and thermographic investigations were carried out in 32 persons. Sensory nerve conduction velocity, the amplitude of sensory nerve potential, subjective and objective electrical thresholds were determined during the stimulation of each finger. Thermograms were taken before and after the standard cooling test. Statistical analysis has revealed that all the results of electroneurographic and thermographic parameters obtained from the fingers of the same person as well as of all investigated persons are directly connected. Highly significant ($p=0.001$ and 0.01) correlations of second degree were found between electroneurographic and temperature parameters. (6 refs.)

120812 Nonvisual color perception: a critical review. P.K.Kaiser (York Univ., Downsview, Ontario, Canada).
Color Res. & Appl. (USA), vol.8, no.3, p.137-44 (Fall 1983).
Since the last century, there have been a number of claims that people can identify and discriminate color with their fingers. The most completely documented evidence for these claims, begining in 1963, is critically reviewed. It was the hope of the early investigators of this phenomenon that this ability would some day be useful for the blind. The best evidence suggests that people are capable of making certain temperature discriminations and that objects of different reflectances can be discriminated on this basis. The temperature exchange stems from the infrared energy emitted by the skin. Research that has presented evidence for finger color perception was often shown to have methodological problems, including learning to discriminate stimuli by texture cues and failure to adequately blindfold observers and prevent use of visual information. The present review concludes that the phenomenon of using the fingers to 'see' color does not and will not, in the forseeable future, provide any additional hope for the blind. (30 refs.)

120813 Cryobiology, the position in the system of life sciences, its contents and terminology. R.Klen (Faculty Hospital, Hradec Kralove, Czechoslovakia).
Indian J. Cryog., vol.8, no.2, p.67-73 (1983).
Cryobiology deals with life under suboptimal temperatures, and studies therefore the effects of low temperature upon life processes. Like many other analogous disciplines, cryobiology has a general part, and a specialized part which deals with either botanical or zoological aspects, predominantly at the level of cytology. The chief subject matter of the botanical applied branch are questions associated with the adaptation of plants to low temperature; among the main problems of the zoological applied branch are preservation by cold and deep-freeze-drying of biological material, and a number of purely medical applications, such as hypothermia, cryosurgery, and treatment of frostbites. (no refs.)

120814 Heat and water vapor transport in the human upper airways at hyperbaric conditions. M.L.Nuckols (Naval Coastal Systems Center, Panama City, FLA, USA), J.L.Zumrick, C.E.Johnson.
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.24-30 (Feb. 1983). [received: Oct. 1983]
Heat and mass transfer mechanisms have been characterized in physical models of human cadaver airways to simulated depths of 305 m with various gas mixtures. Such characterizations offer a detailed understanding of the effects of environmental pressures, gas composition, and respiratory rates (RMV) on the body cooling capacity of the respiratory airways. Empirical heat transfer relationships in the form $Nu=ARe^NPr^{1/3}$ are derived for the oral and nasal passageways during inhalation and exhalation flows. Nu, Re, and Pr are the dimensionless Nusselt, Reynolds, and Prandtl numbers, respectively. The Nusselt and Reynolds numbers are based on the diameter and gas flow rate in the trachea and are applicable to Reynolds number values up to 70,000. (22 refs.)

120815 Model simulation of heat and water transport dynamics in an airway. G.M.Saidel (Dept. of Biomedical Engng., Case Western Res. Univ., Cleveland, OH, USA), K.L.Kruse, F.P.Primiano,Jr..
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.188-93 (May 1983). [received: Oct. 1983]
Heat and water transport processes in the respiratory tract depend on environmental conditions, breathing patterns, and the physiological state of the respiratory system. To study these processes, the authors have developed a mathematical model of the dynamics of temperature and water vapor in the radial and axial directions of an idealized trachea. The model is expressed as two implicit finite-difference equations and solved using an alternating-direction algorithm. Using these equations, the authors simulated the effects of inspired gas temperature and humidity, velocity profile, and flow rate on heat and water transport between the gas and airway wall. Under inspired gas conditions of low temperatue or high relative humidity, supersaturation occurs. Increasing either the velocity gradient at the wall or the flow rate increases the heat and water transport rates. However, these rates change by only 10 percent when the velocity gradient is doubled, and by about 35 percent when flow rate undergoes a two-fold change. The model can be used with in-vivo data from the trachea to test hypotheses concerning normal and abnormal heat and water transport. (15 refs.)

Spin-one lattice gas model for isotherm-reversal in spin-labelled lipid monolayers .... See Entry 120803

Thermal instability in lamellar phases of lecithin: a planar undulation model .... See Entry 120804

Cardiac output and skin blood flow in lean and obese individuals during exercise in the heat .... See Entry 120882

Effect of temperature on the contractile properties and muscle power of triceps surae in humans .... See Entry 120886

Canine blood volume and cardiovascular function during hyperthermia .... See Entry 120891

Steady-state analysis and evaluation of a new thermal sensor for surface measurements of tissue perfusion .... See Entry 121030

Development of a cryoprobe suitable for gynaecological applications .... See Entry 121049

87.20 MEMBRANE BIOPHYSICS

120816 Permeability of the canine visceral pleura. G.T.Kinasewitz, L.J.Groome, R.P.Marshall, J.N.Diana (Dept. of Medicine, Louisiana State Univ. Medical Center, Shreveport, LA, USA).
J. Appl. Physiol. (USA), vol.55, no.1, p.121-30 (July 1983).
Fluid and protein movement across the pulmonary endothelial membrane (PEM) and adjacent mesothelial layer of the visceral pleura was quantitatively analyzed in terms of a two-compartment model of fluid exchange. The left lungs of 13 spontaneously breathing anesthetized dogs were enclosed in a water-impermeable membrane, creating a visceral pleural space; fluid flux was determined as the filtration or reabsorption of water and protein in the visceral pleural space. Aortic, pulmonary arterial, left atrial, and pleural pressures were monitored; oncotic pressure was calculated from the protein concentration of plasma and pleural fluid. It is concluded that it is the pulmonary endothelial membrane that determines the rate and composition of visceral pleural fluid flux in response to hydrostatic and oncotic gradients in the intact animal. (39 refs.)

Critical behavior of a three-dimensional dimer model ....See Entry 117108

Spin-one lattice gas model for isotherm-reversal in spin-labelled lipid monolayers ....See Entry 120803

Effect of high pressure on a lipid non-bilayer phase ....See Entry 120805

Mutant analysis shows that the Ca^{2+}-induced K^+ current shuts off one type of excitation in Paramecium ....See Entry 120821

Role of the physical characteristics of laser radiation in light absorption by haeme-containing biological membranes ....See Entry 120948

Effect of light on the membrane potential of the cells of Neurospora crassa ....See Entry 120958

Effect of irradiation on the microviscosity of the nuclear membrane of tumour and liver cells of tumour bearing animals ....See Entry 120964

Determination of the thickness of inhomogeneous membrane by the optical method ....See Entry 121058

A differential capacitive transducer for continuous recording the mass flows through epithelia by immersion weighing ....See Entry 121079

Mechanical characterization of membranelike biological tissue ....See Entry 121084

87.25 CELLULAR BIOPHYSICS

120817 Study of the mobility of the protoplasm in the cells of the alga Nitella by optical Doppler spectroscopy. M.V.Yevdokimov, A.V.Priyezzhev, Yu.M.Romanovskii, Ye.B.Chernyayeva (Phys. Faculty, Lomonosov State Univ., Moscow, USSR).
Biophysics (GB), vol.27, no.5, p.965-7 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.5, p.918-20 (1982). [received: Sept. 1983]
Optical Doppler spectroscopy has been used to study the restoration of the flow of protoplasm in Nitella cells after shock induced by electrical stimulation. Spectra are presented which show two components: the Doppler component proper and a low frequency component. These components are discussed. (9 refs.)

120818 Motility and mechanosensitivity of macrocilia in the ctenophore Beroe. S.L.Tamm (Marine Biological Lab., Boston Univ., Woods Hole, MA, USA).
Nature (GB), vol.305, no.5933, p.430-3 (29 Sept. 1983).
Reports that macrocilia on the ctenophore Beroe beat discontinuously with separate effective and recovery strokes, resulting in 'split-cycle' waves of metachronal coordination. This new pattern of ciliary beating is used to investigate the motile responses of cilia to controlled mechanical stimuli during each phase of the beat cycle. (25 refs.)

Orientation of the primary donor in single crystals of Rhodopseudomonas viridis reaction centres ....See Entry 120806

S_1 absorption of chlorophyll-a in the red region ....See Entry 120808

Charged amino acids as spectroscopic determinants for chlorophyll in vivo ....See Entry 120810

Change in the mechanical parameters as a possible mode of information processing by the neurone ....See Entry 120826

Burst discharge in mammalian neuroendocrine cells involves an intrinsic regenerative mechanism ....See Entry 120836

Immunocytochemically identified vasopressin neurons in culture show slow, calcium-dependent electrical responses ....See Entry 120837

A functional model of the wiring of the simple cells of visual cortex ....See Entry 120847

The RBE of the leakage radiation from the Hiletron neutron therapy unit ....See Entry 120947

Biological aspects of light distribution in scattering media ....See Entry 120949

Effect of light on the membrane potential of the cells of Neurospora crassa ....See Entry 120958

Sharp resonances in yeast growth prove nonthermal sensitivity to microwaves ....See Entry 120960

Effect of X radiation on the number of pulmonary alveolar macrophages ....See Entry 120961

Erythropoietic effect of ultraviolet radiation in blind rats in comparison with control seeing rats ....See Entry 120962

Effect of irradiation on the microviscosity of the nuclear membrane of tumour and liver cells of tumour bearing animals ....See Entry 120964

Microbubble formation induced in organisms by irradiation ....See Entry 120965

Diagnostic potential of magneto-photoacoustic spectroscopy ....See Entry 120976

A new method for automatic metaphase finding adaptable to different chromosome preparations ....See Entry 121061

Recent advances in laser fluorescence microscopy ....See Entry 121063

Unbiased linear property estimation for spheres, from sections exhibiting overprojection and truncation ....See Entry 121073

A waveguide pulse-echo system for ultrasonic absorption measurements in biological media ....See Entry 121080

The use of a versatile specimen holder to prepare cultured cells for scanning electron microscopy ....See Entry 121082

Pumonary macrophage phagocytosis: quantification by secondary and backscattered electron imaging ....See Entry 121083

87.25D Biological transport; cellular and subcellular transmembrane physics

120819 Permeability of premature lamb lungs to protein and the effect of surfactant on that permeability. A.Jobe, M.Ikegami, H.Jacobs, S.Jones, D.Conaway (Dept. of Pediatrics, Harbor-Univ. of California Medical Center, Torrance, CA, USA).
J. Appl. Physiol. (USA), vol.55, no.1, p.169-76 (July 1983).
The permeability of the alveolar epithelium of prematurely delivered lambs supported on ventilators was studied by following the movement of radiolabeled albumin and protein into and out of the airways. Twenty-two lambs (approximately 136 days gestational age) were killed at times ranging from birth to 3 h of age. As assessed by alveolar wash, 11.5%/h of ^{125}I-albumin administered to these lambs in fetal lung fluid at birth left the airways, while 1.7%/h of the arterially injected dose of ^{131}I-albumin entered the airways. Total protein increased in the alveolar washes by 60 mg.kg^{-1}.h^{-1}, concurrently, with an increase in the quantity of inhibition by the soluble proteins of the surface tension lowering properties of surfactant. This large bidirectional flux of protein indicates very abnormal permeability properties of the alveolar epithelium of prematurely delivered and ventilated lambs with normal blood gases. To assess the effect of surfactant on the permeability, one lamb of each of eight pairs of twin lambs was treated with 50 mg/kg natural sheep surfactant at birth, and all 16 lambs were supported on ventilators for 3 h. The surfactant treatment significantly decreased the radiolabeled albumin flux and the total protein present in the alveolar washes. (25 refs.)

120820 Pulmonary uptake of mannitol as an index of changes in lung epithelial permeability. S.M.Taylor, H.Downes, C.A.Hirshman, J.E.Peters, D.Leon (Dept. of Pharmacology & Anesthesiology, Oregon Health Sci. Univ., Portland, OR, USA).
J. Appl. Physiol. (USA), vol.55, no.2, p.614-18 (Aug. 1983).
To develop a simple, inexpensive, and nontoxic test for changes in bronchial permeability the authors have employed a specific gas chromatographic assay to measure the uptake of mannitol from the lung after administration of an intratracheal aqueous bolus (8 ml of 5% solution). They have tested the ability of their method to detect the known increase in lung epithelial permeability elicited by challenge of previously sensitized animals with aerosols of Ascaris suum antigen. In Ascaris-sensitive Besenji-Greyhound dogs, antigen challenge significantly increased the rate of appearance and peak plasma level of mannitol after administration of the intratracheal bolus. Peak plasma mannitol levels averaged 25 ± 3 (SE) μg/ml in dogs challenged with Ascaris antigen aerosols, and 14 ± 2 μg/ml in the same animals in separate control experiments employing saline aerosols. The method presented could be readily applied to animal and human studies as a simple, inexpensive, and nontoxic indicator of lung epithelial permeability. (22 refs.)

120821 Mutant analysis shows that the Ca^{2+}-induced K^+ current shuts off one type of excitation in Paramecium. Y.Saimi, R.D.Hinrichsen, M.Forte, C.Kung (Lab. of Molecular Biology, Univ. of Wisconsin, Madison, WI, USA).
Proc. Natl. Acad. Sci. USA, vol.80, no.16, p.5112-16 (Aug. 1983).
Two mutants of Paramecium tetraurelia, called 'pantophobiacs', were found to lack most of the slow Ca^{2+}-induced K^+ outward current. Passive properties, the transient Ca^{2+}inward current, and the fast depolarization-induced K^+ outward current remain normal. The mutant defect reduces the ability to shut off a normal, excited state of the membrane and results in repeated, long backward swimming instead of the wild-type jerks in response to a variety of ions, to heat, and to touch. (44 refs.)

120822 Abnormal ion permeation through cystic fibrosis respiratory epithelium. M.R.Knowles, M.J.Stutts, A.Spock, N.Fischer, J.T.Gatzy, R.C.Boucher (Dept. of Medicine, Univ. of North Carolina School of Medicine, Chapel Hill, NC, USA).
Science (USA), vol.221, no.4615, p.1067-70 (9 Sept. 1983).
The epithelium of nasal tissue excised from subjects with cystic fibrosis exhibited higher voltage and lower conductance than tissue from control subjects. Basal sodium ion absorption by cystic fibrosis and normal nasal epithelia equalled the short-circuit current and was amiloride-sensitive. Amiloride induced chloride ion secretion in normal but not cystic-fibrosis tissue and consequently was more effective in inhibiting the short-circuit current in cystic fibrosis tissue epithelia. Chloride ion-free solution induced a smaller hyperpolarization of cystic fibrosis tissue. The increased voltage and amiloride efficacy in cystic fibrosis reflect absorption of sodium ions across an epithelium that is relatively impermeable to chloride ions. (20 refs.)

Heat and water vapor transport in the human upper airways at hyperbaric conditions ....See Entry 120814

Model simulation of heat and water transport dynamics in an airway ....See Entry 120815

Bioelectric properties and ion transport in the isolated frog lung ....See Entry 120823

Inexpensive laser Doppler instrument for cell electrophoresis ....See Entry 121064

87.30 BIOPHYSICS OF NEUROPHYSIOLOGICAL PROCESSES

(exc. perception processes and speech)

120823 Bioelectric properties and ion transport in the isolated frog lung. T.Tyrakowski, G.Szymkowiak, A.Kubacki (Dept. of Pathophysiology, School of Medicine, Poznan, Poland).
Acta Physiol. Pol. (Poland), vol.34, no.1, p.117-25 (Jan.-Feb. 1983). [received: Sept. 1983]
The aim of the study is the comparison of the basic features of the isolated amphibians lungs (R. temporaria with B. marinus and R. catesbeiana) and the evaluation of this preparation as a model of the chloride transport. Measurements of the bioelectric properties of the isolated lungs were performed according to Ussing (1951), Chloride unidirectional fluxes were measured in chambers described by Helman (1971) according to Gatzy (167). The spontaneous potential difference of the lung was of the range of millivolts. The short circuit current was of the order of microamperes. The net flux of chloride was directed to the mucosal side. The current-voltage relationship was linear in the range of the ±30 microamperes. The measured functions were stable during the study only when the ambient temperature was about 10°C. (16 refs.)

120824 Impact of recruitment order on electrode design for neural prosthetics of skeletal muscle. J.S.Petrofsky (Dept. of Engng. & Physiology, Wright State Univ., Dayton, OH, USA), C.A.Phillips.
Am. J. Phys. Med. (USA), vol.60, no.5, p.243-53 (Oct. 1981). [received: Sept. 1983]
The impact of recruitment order on isometric and dynamic endurance was examined in the cat to determine the optimal pattern of recruitment which can be used to stimulate skeletal muscle. The experiments were conducted on the medial gastrocnemius muscle of the cat, a muscle with a mixed composition of muscle fibers (both fast twitch and slow twitch motor units). Two orders of motor unit recruitment were examined, recruitment from the fastest to slowest motor units and recruitment from the slowest to fastest motor units. The results of these experiments showed that while recruitment order had little effect on the endurance for dynamic exercise, the endurance for isometric exercise at low tensions was less with recruitment proceeding from the fastest to slowest rather than the slowest to fastest motor units. The implications of these results in electrode design are discussed. (39 refs.)

120825 Human factors and behavioral science: central control of movement timing. D.A.Rosenbaum (Bell Labs., Murray Hill, NJ, USA).
Bell Syst. Tech. J. (USA), vol.62, no.6, pt.3, p.1647-57 (July-Aug. 1983).
Examines the mechanisms of movement timing. Of necessity, the experiment that has been reported involved a restricted type of movement, namely simple finger sequences. Yet the experiment appears to have fairly broad theoretical importance for our understanding of how movements are timed. In particular, the experiment suggests that even when peripheral feedback is available, central programs play a controlling role in movement timing. (21 refs.)

120826 Change in the mechanical parameters as a possible mode of information processing by the neurone. Ye.A.Liberman, S.V.Minina, N.Ye.Shklovskii-Kordi, M.Conrad (Inst. of Problems of Information Transmission, Acad. of Sci., Moscow, USSR).
Biophysics (GB), vol.27, no.5, p.906-15 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.5, p.863-70 (1982). [received: Sept. 1983]
Depolarization of the membrane of the neurone induced by cyclic AMP was detected both by the method of ionophoresis and injection under pressure. Inflation of the neurone at the moment of injecting various substances by pressure caused depolarization of the membrane with much the same time course as the effect of cyclic nucleotides. The influence of cAMP with use of pressure was detected with inhibitors of phosphodiesterase. The similarity of the effects of the cyclic nucleotides and mechanical stimulation of the neurone suggest that in both cases the action is mediated by a mechanical system consisting of a microskeleton and micromuscles. The hypothesis is advanced that the intraneurone information processing is carried out with such an analogue system. (33 refs.)

120827 Mechanism of the origin of the helical waves in active media associated with the phenomenon of critical curvature [bioelectrical application]. A.V.Panfilov, A.M.Pertsov (Inst. of Biological Phys., Pushchino, USSR).
Biophysics (GB), vol.27, no.5, p.931-4 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.5, p.886-9 (1982). [received: Sept. 1983]
Computer study of a two-dimensional active medium described by Fitz-Hugh and Nagumo equations has revealed a new mechanism of the origin of helical waves. It is shown that when the wave bends round the partition on which the Neumann boundary conditions are set it breaks away from the boundary with formation of a break of the front which then evolves into a helix. The effect is observed when the curvature of the break is close to the critical value for the given medium. (8 refs.)

120828 Mechanism of the origin of the first extrasystole in short-lived atrail arrhythmia. A.B.Medvinskii, A.M.Pertsov (Inst. of Biological Phys., Acad. of Sci., Pushchino, USSR).
Biophysics (GB), vol.27, no.5, p.940-4 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.5, p.895-9 (1982). [received: Sept. 1983]
Using the mapping method (at 80-150 points) on strips of the rabbit left atrium, the authors have studied the spread of excitation in arrhythmias induced by electrical stimulation in the vulnerable phase. The arrhythmias were initiated in normal conditions and against a background of acetylcholine (0.2 mg/l.). The electrical activity was recorded with surface electrodes. It was shown that the first extrasystolic wave, as a rule, is due to the appearance of one or more point or ring-like sources of excitation on the surface of the myocardium. Continuous circulation of the excitation wave over the surface of the heart tissue was absent. The possible mechanisms of the origin of such sources are discussed. Circulations of excitation deep in the myocardium (intramural return) are regarded as the most probable mechanism. (12 refs.)

120829 Refractoriness of heart tissue with fall in the fast Na influx. Comparison of atrium and ventricle. A.K.Grenader, V.M.Ponomareva, G.G.Zurabishvili, B.N.Basiyev (Inst. of Biological Phys., Acad. of Sci., Pushchino, USSR).
Biophysics (GB), vol.27, no.5, p.957-60 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.5, p.911-14 (1982). [received: Sept. 1983]
On strips of the left atrium and the wall of the right ventrical of the rabbit heart the value of the fast Na influx (I_{Na}) was reduced by replacing NaCl in the perfusion solution by sucrose and also by the action of low concentrations of anti-arrhythmia blockers of I_{Na} (lidocaine, diphenylhydantoin and ethmosine). It is shown that fall in I_{Na} increases the refractoriness (R) of the atrium and has little effect on R of the ventricle. Further fall in I_{Na} also increases R of the ventricle. It is postulated that rise in R with fall in I_{Na} is one of the mechanisms of the raised sensitivity of ischaemia-damaged tissue of the ventricle of the heart to anti-arrhythmia blockers of I_{Na}. (11 refs.)

120830 Computer analysis of prolongation of cardiac action potential duration. T.Ban (Dept. of Pharmacology, Yamaguchi Univ., Yamaguchi, Japan).
Comput. & Biomed. Res. (USA), vol.16, no.5, p.403-13 (Oct. 1983).
Using Beeler and Reuter's mathematical model of action potential in myocardial fibers, a similar extent of prolongation of action potential duration at -60 mV (APD_{-60}) was produced at the infinite interval of stimulation by altering parameter values for slow inward current (i_s) time-independent (i_{k1}) and time-dependent (i_{x1}) outward currents. Among five types of prolongation of APD_{-60} thus produced, the plateau height is high in two types at this interval, but in three at a shorter interval. The degree of prolongation varies between these five types at this shorter interval. The stimulus interval-action potential duration (interval-duration) relation curves reflect changes in time-dependent parameters of these currents. Thus various types of APD prolongation may be distinguished from each other by the different behavior of action potentials at low and high frequencies of stimulation. i_{x1} increases by 40-fold at the moment of the maximum rate of depolarization at an interval of 330 msec, but is still negligibly small as compared with sodium current. (15 refs.)

120831 Computer simulation of the cardiac conduction system. M.Malik, T.Cochrane, A.J.Camm (Dept. of Cardiology, St. Bartholomew's Hospital, London, England).
Comput. & Biomed. Res. (USA), vol.16, no.5, p.454-68 (Oct. 1983).
A discrete computer model simulating the operation of the cardiac impulse transmission apparatus and the electropotential changes of the heart musculature has been developed on a NORD-100 minicomputer. The model is written in NORD-FORTRAN and allows description of practically all basic pathologies of the transmission apparatus. A simulated ECG curve is produced in each case. The current version of the model is especially suited for studies of heart rhythms. Pacemaker descriptions (of most important pacemaker types) have been introduced into the model and the computer computations make it possible to assess the effects of different pacemaker modes under different pathological situations. The principle on which the model is based is described and the authors show concisely several examples in the form of simulated ECG records. (6 refs.)

120832 Effects of static muscular contraction on impulse activity of groups III and IV afferents in cats. M.P.Kaufman, J.C.Longhurst, K.J.Rybicki, J.H.Wallach, J.H.Mitchell (Depts. of Physiology & Internal Medicine, Univ. of Texas Health Sci. Center, Dallas, TX, USA).
J. Appl. Physiol. (USA), vol.55, no.1, p.105-12 (July 1983).
Static contraction of the hindlimb muscles, induced by electrical stimulation of the ventral roots, reflexly increases arterial blood pressure and heart rate. Although stimulation of groups III and IV muscle afferents is believed to cause these reflex increases, the response of these afferents to a level of static contraction that increases arterial pressure have not yet been determined. Therfore, in barbiturate-anesthetized cats, afferent impulses arising from endings in the gastrocnemius muscle were recorded from the L_7 or S_1 dorsal roots, while the cut peripheral end of the L_7 ventral root was stimulated. Results suggest that, although both groups III and IV muscle afferents contribute to the reflex cardiovascular increases evoked by static exercise, group III fibers were likely to be stimulated by the mechanical effects of muscular contraction, whereas at least some group IV fibers were likely to be stimulated by the metabolic products of muscular contraction. (24 refs.)

120833 Factors determining the frequency content of the electromyogram. H.Kranz, A.M.Williams, J.Cassell, D.J.Caddy, R.B.Silberstein (Dept. of Neurology & Clinical Neurophysiology, Alfred Hospital, Melbourne, Victoria, Australia).
J. Appl. Physiol. (USA), vol.55, no.2, p.392-9 (Aug. 1983).
The contribution of central and peripheral factors to the frequency content of the electromyogram was examined in 10 subjects performing maximal 45-s contractions of thenar muscles. The median frequencies (F_m) of surface-recorded electromyograms and compound action potentials were similar early ($P>0.6$) and late ($P>0.5$) in the contractions. There was a mean decrease in the F_m during contraction of 39% for electromyograms and 35% for compound potentials ($P>0.1$). The F_m of electromyograms increased 11% ($P<0.02$) in only the 1st s of contraction as force was raised from 25 to 100% of maximum. Only one of five subjects showed evidence of increasing synchronization of motor unit discharge during contraction. There was no evidence that delay or dispersion of action potential propagation in terminal nerve fibers or at the neuromuscular junction had a significant effect on frequency content. The findings indicated that the spectral content of muscle electrical activity, and its shift during contraction, primarily reflects intrinsic muscle properties. (33 refs.)

120834 A model for the nerve impulse propagation using two first-order differential equations. K.Rajagopal (Dept. of Phys., Bharathidasan Univ., Tamilnadu, India).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.77-8 (3 Oct. 1983).
A simple model is proposed for the nerve impulse propagation using two first-order differential equations, which are found to be completely integrable. The solutions have been obtained explicitly in terms of elliptic functions to the propagating waves and pulses. This model also predicts linearity of the frequency-current relationships. (7 refs.)

120835 Patch-recorded single-channel currents of the purified and reconstituted Torpedo acetylcholine receptor. D.W.Tank (Dept. of Phys., Cornell Univ., Ithaca, NY, USA), R.L.Huganir, P.Greengard, W.W.Webb.
Proc. Natl. Acad. Sci. USA, vol.80, no.16, p.5129-33 (Aug. 1983).
Small unilamellar vesicles containing purified and reconstituted nicotinic acetychlorine receptors from Torpedo electroplax have been fused by a simple freeze-thaw procedure to form large liposomes. Giga-seal patch-recording techniques were used to form isolated patches of loposome-membrane and to measure single-channel properties of the reconstituted receptor-ion channel complex. The observed properties are quantitatively similar to those reported for vertebrate muscle nicotinic acetylcholine receptor species recorded in situ. The results demonstrate that the pentameric complex consisting of the $\alpha_2\beta\gamma\delta$ subunits is fully functional. The methods used in these experiments should be useful in studying the effects of chemical alterations on the properties of acetycholine receptor channels as well as other types of purified and reconstituted ion channels. (20 refs.)

120836 Burst discharge in mammalian neuroendocrine cells involves an intrinsic regenerative mechanism. R.D.Andew, F.E.Dudek (Dept. of Physiology, Tulane Univ. School of Medicine, New Orlenas, LA, USA).
Science (USA), vol.221, no.4615, p.1050-2 (9 Sept. 1983).
Intracellular recordings from mammalian neuroendocrine cells showed that steady, injected currents can modify and block periodic spike bursts previously associated with increased neurohormone release. Spike afterpotentials could sum to form plateau potentials, which generated bursts and did not depend on axonal conduction or chemical synapses. Therefore, bursting involves a spike-dependent, positive-feedback mechanism endogenous to single neuroendocrine cells. (22 refs.)

120837 Immunocytochemically identified vasopressin neurons in culture show slow, calcium-dependent electrical responses. D.T.Theodosis, P.Legendre, J.D.Vincent (Unite de Recherches de Neurobiologie des Comportements, INSERM, Bordeaux, France).
Science (USA), vol.221, no.4615, p.1052-4 (9 Sept. 1983).
From morphological characterization and intracellular recordings, monolayer cultures derived from fetal mouse hypothalami were found to include functionally differential peptide neurons, a number of which appear to contain vasopressin. These cells exhibited particular patterns of slow, calcium-dependent membrane depolarizations, resembling in their periodicity and duration the phasic activity of vasopressin neurons recorded extracellularly in vivo. (11 refs.)

Relationship between sensory nerve conduction and temperature of the hand ....See Entry 120811

Mutant analysis shows that the Ca^{2+}-induced K^+ current shuts off one type of excitation in Paramecium .... See Entry 120821

Abnormal ion permeation through cystic fibrosis respiratory epithelium ....See Entry 120822

Relationship between length and strength in heart muscle. Electromechanical coupling on deformation of the myocardium .... See Entry 120877

Effects of phrenic stimulation on upper airway resistance in anesthetized dogs .... See Entry 120896

Correlation of myoelectric activity and muscle force during selected cat treadmill locomotion .... See Entry 120915

Effect of light on the membrane potential of the cells of Neurospora crassa .... See Entry 120958

A variable pulse-burst electromagnetic generator for electrical stimulation of biological systems .... See Entry 120980

Accuracy of computer measurements of QRS duration using spatial magnitude—agreement with human readers .... See Entry 121033

Detection of muscle tremors and baseline sway in an ECG ... See Entry 121034

Subtraction of electrocardiographic signal from respiratory electromyogram .... See Entry 121039

An optimal linear filter for the reduction of noise superimposed to the EEG signal .... See Entry 121041

Development of an electromyogram (EMG) controlled above-knee prosthesis using microcomputer .... See Entry 121057

A computer system for real-time data acquisition and analysis of biopotentials and quantal content at the neuromuscular junction .... See Entry 121059

Automated analysis of neuromuscular 'jitter' .... See Entry 121060

The complex-shaped 'perforated' synapse, a problem in quantitative stereology of the brain .... See Entry 121075

A microcomputer system for real-time analysis of cardiac action potentials .... See Entry 121078

87.32 PHYSIOLOGICAL OPTICS, VISION

120838 How do sense organs make sense. S.L.Boersma (Engng. Consultant, N Beetslaan, Delft, Netherlands).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.10-14 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A sense organ is a nonlinear operator operating on an external field. It performs a dual task: a. Data reduction by many orders of magnitude. b. Making sense, that is producing individual-invariant data out of the raw stream. A Wigner distribution function is a suitable operator for both hearing and vision fields. In hearing it leads to frequency, tone, perception. In vision it produces ray directions. Now tactile, auditory and visual information fit together into a single perception spectrum. Relations are shown to exist between the specification of eye, ear and tactile sense. These relations hold for many species of animals, including insects. (5 refs.)

120839 A cascade model of the retinal nervous system. T.Hirose, I.Mizoshiri (Dept. of Electrical Engng., Ritsumeikan Univ., Kyoto, Japan).
Mem. Res. Inst. Sci. & Eng. Ritsumeikan Univ. (Japan), no.40, p.57-65 (1981).
The paper concerns the frequency characteristics of the visual system. The spatial modulation transfer function (MTF), the temporal MTF and the spatio-temporal frequency characteristics of the visual system were measured. It is assumed that the retinal nervous system is linear and that spatial and temporal systems are independent of one another. The simplest cascade model of the retinal nervous system is proposed. The spatio-temporal responses and frequency characteristics of the cascade model are calculated and the lateral inhibition corresponding with the negative part of response is also yielded. (6 refs.)

120840 The effects of contact lens deformation on tear film pressure and thickness during motion of the lens towards the eye. H.D.Conway, M.W.Richman (Dept. of Theoretical & Appl. Mech., Cornell Univ., Ithaca, NY, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.47-9 (Feb. 1983). [received: Oct. 1983]
An analysis is made of the motion of a contact lens normal to the eye through a tear film. The eye is modeled as a rigid sphere and the lens as a deformable spherical cap. Graphs of pressure distribution and tear film thickness variations are obtained. It is found that the pressures are very markedly reduced and film thicknesses increased by decreasing the modulus of the lens materials. (6 refs.)

SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82 .... See Entry 116913

87.32C Anatomy and optics of the eye

120841 Correlation and interferometric light scattering studies of the lens of the eye. P.N.Pusey, J.T.Randall, J.M.Vaughan (Royal Signals & Radar Establishment, Gt. Malvern, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.29-34 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Techniques of dynamic light scattering have been applied to biological lens material in recent years by a number of authors. The enhanced scattering due to cataract, leading to eventual opacity, has been described by two related models—one ascribing the phenomenon to aggregations of the globular crystallines and the other to a phase separation. The authors' observations of Brillouin scattering, and correlation studies of diluted material, indicate some degree of simple aggregation. However, work on natural and homogenised material (including human, bovine and fish lenses) shows very slow fluctuations which suggest more complex interactions. (10 refs.)

120842 The geometric and Fourier transform solutions for the object-image conjugated interference field of human retina in the visual acuity examination by laser interferometry. Dong Taihuo, Ma Changming (Optical Instruments Dept., Zhejiang Univ., Zhejiang, China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.311-17
The LIRVA (laser interferometric retinal visual acuity) tester provides an effective means for the preoperation examination of cataracts. On the bases of theory and experiment, the authors suggest that the retinal interference pattern as seen by a cataractous patient is a reconstructed image of the tester's initial interference field which results after two optical transforms by the imaging optical system and eye, and is not simply formed by the two coherent spot-sources which are entered and sited at the eye nodal point. (16 refs.)

87.32E Physiology of the eye; nerve structure and function

120843 Dependence of the simple motor reaction time on the luminance in the dark adaptation state. P.Jaskowski, A.Pilawski (Dept. of Biophys., School of Medicine, Poznan, Poland).
Acta Physiol. Pol. (Poland), vol.33, no.3, p.157-61 (May-June 1982). [received: Sept. 1983]
In a group of 16 persons with normal vision the simple motor reaction time to visual stimuli was measured depending on the luminance in the dark adaptation state. It was found that this relation was well described by a power function. The exponent was not dependent on the individual subject and was equal to $\beta=0.29\pm0.02$. It was found that the value of s for a single subject, who took part in this type of experiment for the first time, could be measured with a standard deviation of 0.10. (13 refs.)

120844 Dependence of simple motor reaction time on luminance in various adaptation states. P.Jaskowski (Dept. of Biophys., Medical Acad., Poznan, Poland).
Acta Physiol. Pol. (Poland), vol.33, no.3, p.163-8 (May-June 1982). [received: Sept. 1983]
For different levels of eye adaptation to light the reaction to visual stimuli depending on the luminance was measured. The results proved to be described by the relationship $L=L_\infty+k(I-I_0)^{-\beta}$ (where L—reaction time; I—luminance of the stimulus; L_∞—reaction time, if $I\rightarrow\infty$; β, k are constants). The parameters β, k and I_0 changed parallelly with luminance changes of the adapting field. In particular, I_0 behaved as the threshold luminance at a given background luminance. It was found that there exists a constant C, not depending on the level of adaptation. (6 refs.)

120845 Space-frequency characteristics of the receptive fields of the cat visual cortex in conditions of homogeneous and inhomogeneous backgrounds. V.D.Glezer, V.Ye.Gauzel'man, V.M.Bondarko, T.A.Shcherbach (Pavlov Inst. of Physiology, Acad. of Sci., Leningrad, USSR).
Biophysics (GB), vol.27, no.5, p.915-19 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.5, p.871-4 (1982). [received: Sept. 1983]
The authors have studied the space-frequency characteristics of the cortical receptive fields obtained on a sinusoidal lattice after their presentation against a background consisting of the same orthogonally oriented lattices and against a uniform background. The results correspond to notions on linear independence in orientation for the receptive field acting as a filter of spatial frequency. (10 refs.)

120846 Model interpretation of visual-vestibular interaction in patients with labyrinthine and cerebellar pathologies. A.Buizza, R.Schmid (Dipartimento di Informatica e Sistemistica, Univ. di Pavia, Pavia, Italy).
Biol. Cybern. (Germany), vol.47, no.3, p.203-11 (1983).
Oculomotor responses to combined optokinetic and vestibular stimulations in labyrinthine and cerebellar defective patients are discussed in terms of parametric changes in a model describing the interaction between the vestibulo-ocular reflex (VOR) and the optokinetic reflux (OKR). The model can be used to define a set of parameters giving an estimate of the state of the system subserving VOR-OKR interaction in the examined patients. The model is also shown to be a powerful tool to assess the validity and the diagnostic significance of the procedures used to test VOR-OKR interaction. (27 refs.)

120847 A functional model of the wiring of the simple cells of visual cortex. D.E.Nielsen (Inst. of Neurophysiology, Panum Inst., Copenhagen, Denmark).
Biol. Cybern. (Germany), vol.47, no.3, p.213-22 (1983).
A computer model of the simple cells in the mammalian visual cortex is constructed. The model cells received inputs from a great number of isopolar centre/surround cells assumed to be located in the lateral geniculate nucleus (LGN). In all the situations tested, the responses of the model cells corresponded qualitatively very well to those of living cells. It was seen that the same writing mechanism was able to account for orientation selectivity, spatial frequency filtering, various phase relationships between stimulus and response, subfield orientational selectivity, and slight end-inhibition. Furthermore, the receptive fields of the model simple cells closely resemble Gabor functions. (16 refs.)

120848 The mass receptor potential in the study of enzymatic processes in the vertebrate retinal photoreceptors. S.Hemila.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.50-7 (1983).
The DC amplified transretinal voltage of the aspartate-treated retina is useful in the study of excitation and adaptation of the rod photoreceptor, but secondary currents brought about by rod excitation have to be taken into account. Experiments using this technique are presented, showing that phosphodiesterase inhibitors cause large transient increases in the sodium 'dark current'. This indicates that cyclic GMP opens more sodium channels in the rod plasma membrane. (23 refs.)

120849 Laser speckle technique for the visualization of retinal blood flow. J.D.Briers, A.F.Fercher (Univ. of Essen, Fachbereich Phys., Essen, Germany).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.22-8 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A single-exposure laser speckle photography technique is being developed for the visualization of velocity distributions in flow fields. Of particular interest is its application to the in vivo mapping of retinal blood flow. The basic principles of the technique are outlined, together with a mathematical model and some experimental results using rotating diffusers. Some preliminary results from a human retina are also presented. (15 refs.)

120850 A cholinergic-sensitive channel in the cat visual system tuned to low spatial frequencies. T.H.Harding, R.W.Wiley, A.W.Kirby (US Army Aeromedical Res. Lab., Fort Rucker, AL, USA).
Science (USA), vol.221, no.4615, p.1076-8 (9 Sept. 1983).
Visually evoked responses to counterphased gratings were recorded from the cat visual cortex before and after physostigmine administration. Physostigmine markedly reduced the responses to low spatial frequencies, but minimally affected the response to high frequencies. This effect is considered cholinergic since it could be reversed by atropine. These results support at least a two-channel model of spatial frequency responsivity. (18 refs.)

A cascade model of the retinal nervous system .... See Entry 120839

Two spatio-temporal filters in human vision. I. Temporal and spatial frequency response characteristics .... See Entry 120855

Two spatio-temporal filters in human vision. II. Selective modification in amblyopia, Albinism, and hemianopia .... See Entry 120856

Adaptive changes in the vestibulo-ocular reflex in flatfish are achieved by reorganization of central nervous pathways .... See Entry 120871

Eye deformation measurement by laser interferometry .... See Entry 120977

87.32L Light detection; adaptation and discrimination

Dependence of the simple motor reaction time on the luminance in the dark adaptation state .... See Entry 120843

Dependence of simple motor reaction time on luminance in various adaptation states .... See Entry 120844

The mass receptor potential in the study of enzymatic processes in the vertebrate retinal photoreceptors .... See Entry 120848

87.32N Colour detection; adaptation and discrimination

120851 Colour vision in animals. G.H.Jacobs (Univ. of California, Santa Barbara, CA, USA).
Endeavour New Ser. (GB), vol.7, no.3, p.137-40 (1983).
The nature of human colour vision has been the subject of much research, and is generally well understood. By contrast, relatively little is known about colour vision in animals. This partly reflects experimental problems for it is difficult to know whether an animal is responding to a colour cue or to some other external stimulus. This article reviews current knowledge about colour vision in vertebrates. (9 refs.)

120852 Recent advances in retinex theory and some implications for cortical computations: color vision and the natural image. E.H.Land (Rowland Inst. for Sci., Cambridge, MA, USA).
Proc. Natl. Acad. Sci. USA, vol.80, no.16, p.5163-9 (Aug. 1983).
Discusses the quantitative procedures used by the author. He uses a laboratory display called a Mondrian which utilises about 100 colored papers. He concludes that retinex theory is a powerful tool that explains many of the basic phenomena of color vision. It predicts many others. (12 refs.)

Multidimensional mapping of 178 Munsell colors .... See Entry 117209

Parametric variations in a threshold color-difference ellipsoid for green painted samples .... See Entry 117210

Influence of experimental parameters on the evaluation of color-difference ellipsoids .... See Entry 117211

On seeing reddish green and yellowish blue .... See Entry 120857

87.32S Psychophysics of vision, visual perception, binocular vision

120853 Human factors and behavioural science: textons, the fundamental elements in preattentive vision and perception of textures. B.Julesz, J.R.Bergen (Bell Labs., Murray Hill, NJ, USA).
Bell Syst. Tech. J. (USA), vol.62, no.6, pt.3, p.1619-45 (July-Aug. 1983).
Gives an overview of some insights into the workings of the human visual system gained during two decades of research at Bell Laboratories, and culminating in the discovery of a few local conspicuous features that the authors call textons. Textons appear to be the basic units of preattentive texture perception, when textures are viewed in a quick glance with no further effort or analysis. Although this article goes beyond texture perception into preattentive vision in general, studies of texture discrimination led to the basic insights presented and provide excellent demonstrations of the main findings. The authors propose a novel theory of vision in which the preattentive visual system inspects a large portion of the visual field in parallel and detects only density differences in textons. It then directs focal attention to these loci of texton differences for detailed scrutiny. (28 refs.)

120854 Human factors and behavioral science: experiments on quantitative judgments of graphs and maps. W.S.Cleveland, C.S.Harris, R.McGill (Bell Labs., Murray Hill, NJ, USA).
Bell Syst. Tech. J. (USA), vol.62, no.6, pt.3, p.1659-74 (July-Aug. 1983).
Behavioral studies are essential for devising guidelines for effective communication of quantitative information from graphs. Three experiments in which subjects made quantitative judgments from three different kinds of graphs lead to several recommendations: use pastel rather than highly saturated colors on statistical maps; standardize the point cloud size relative to the frame on a scatterplot; scale circles by making the circle area proportional the the variable represented, but expect widely varying judgments of the areas. (21 refs.)

120855 Two spatio-temporal filters in human vision. I. Temporal and spatial frequency response characteristics. I.E.Holliday (Dept. of Phys., Imperial Coll. of Sci. & Technol. London, London, England), K.H.Ruddock.
Biol. Cybern. (Germany), vol.47, no.3, p.173-90 (1983).
Visual detection of stimulus movement requires information about changes in both the positional and temporal co-ordinates of the retinal image. Both spatial and temporal frequency response characteristics are investigated. Two spatio-temporal filters, ST 1 and ST 2 are reviewed. It is shown that the ST 2 responses can be obtained by combining ST 1 responses and a network incorporating the two filters is presented. Other similar psychophysical studies which imply the activity of two spatio-temporal filters are also reviewed. (41 refs.)

120856 Two spatio-temporal filters in human vision. II. Selective modification in amblyopia, Albinism, and hemianopia. A.R.Grounds, I.E.Holliday, K.H.Ruddock (Imperial Coll. of Sci. & Technol. London, London, England).
Biol. Cybern. (Germany), vol.47, no.3, p.191-201 (1983).
For pt.I see ibid., vol.47, no.3, p.173 (1983). The psychophysical methods described in part I are used. Data are given for 19 ambloyopes, an albino and a hemianope, and comparison data are also given for a number of subjects with normal vision. The results are displayed graphically to show the amount of deviation from normal behaviour. The results are discussed. (17 refs.)

120857 On seeing reddish green and yellowish blue. H.D.Crane, T.P.Piantanida (Visual Sci. Program, SRI Internat., Menlo Park, CA, USA).
Science (USA), vol.221, no.4615, p.1078-80 (9 Sept. 1983).
Four color names—red, yellow, green, and blue—can be used singly or combined in pairs to describe all other colors. Orange, for example, can be described as a reddish yellow, cyan as a bluish green and purple as a reddish blue. Some dyadic color names (such as reddish green and bluish yellow) describe colors that are not normally realizable. By stabilizing the retinal image of the boundary between a pair of red and green stripes (or a pair of yellow and blue stripes) but not their outer edges, however, the entire region can be perceived simultaneously as both red and green (or yellow and blue). (12 refs.)

120858 Employing properties of the human visual system for image segmentation. C.-E.Liedtke, W.Geuen, D.Wermser (Inst. fur Theor. Nachrichtentech., Univ. Hannover, Hannover, Germany).
Proceedings of the 3rd Scandinavian Conference on Image Analysis, Copenhagen, Denmark, 12-14 July 1983 (Lund, Sweden: Studentlitteratur 1983), p.146-51
One has become used to the fact that the information processing of digital computers is so much superior to that of human beings because of the digital computers precision of data storage and retrieval, its speed, its working in higher dimensions and its ability to perform complicated mathematical operations. This is almost opposite in image processing. While human viewers can easily find contours, differentiate textures, detect and track objects, perceive depth and analyse with ease image contents, present computer based image processing systems perform rather slow and show very limited capabilities. Because of this lack the authors approach to image analysis, especially image segmentation, is to study properties of the human visual system and perception in order to arrive at better algorithms and new concepts for the solution of specific problems in image processing. Results of some of the efforts are presented namely in contour detection, texture analysis, and knowledge representation to be used for the segmentation of natural images. (no refs.)

120859 Image coding based on human vision system properties for optimal reduction of redundancy. A.Ikonomopoulos, M.Kocher, M.Kunt (Lab. de Traitment des Signaux, Ecole Polytech. Federale de Lausanne, Lausanne, Switzerland).
Proceedings of the 3rd Scandinavian Conference on Image Analysis, Copenhagen, Denmark, 12-14 July 1983 (Lund, Sweden: Studentlitteratur 1983), p.216-21
Presents two image coding techniques based on the physiological observation that mammalian visual systems detect and process edge information by special mechanisms. One technique operates in the frequency domain by considering an image as the sum of a low frequency component, in a certain sense representing regions of uniform grey level, and many high frequency components corresponding to edges whose directions fall into limited intervals of angular variation. The second proceeds in the spatial domain by transforming a pixel-composed image into a region composed one, where the region boundaries represent the contour information and the interior pixels the texture information. Experimental results obtained from the above methods appear to be interesting and promising for both high rate data compression and good image quality. (5 refs.)

87.34 AUDITION

120860 Spatial cross-correlation: a proposed mechanism for acoustic pitch perception. G.E.Loeb (Nat. Inst. of Neurological & Communicative Disorders & Stroke, Bethesda, MD, US), M.W.White, M.M.Merzenich.
Biol. Cybern. (Germany), vol.47, no.3, p.149-63 (1983).
A new class of model processes for the extraction of spectral information from the neural representation of acoustic signals is proposed. The detection of synchronicity between two phase-locked signals derived from sources spaced a finite distance apart on the basilar membrane can be used to extract frequency from the spatiotemporal pattern of basilar membrane motion. One particular model of the process, invoking the binaurally sensitive cells of the medial superior olive as the critical detecting elements, has properties which are useful in accounting for certain complex binaural psychophysical observations. (85 refs.)

120861 Normal values of human tympanograms. Rao Yu-an, Yang Qiong-hua, Liang Zhi-an (Shanghai Inst. of Physiology, Acad. Sinica, Shanghai, China).
Acta Acust. (China), vol.8, no.3, p.140-6 (May 1983). In Chinese. [received: Oct. 1983]
Acoustic compliance was measured and calculated on tympanograms taken from 160-171 otologically normal human ears with the Middle-ear-function-measuring Apparatus, the test frequency being 300 Hz. The averaged maximum compliance was found to be 1.16 ml at zero ear-canal pressure (C_0), and 1.29 ml at the point where the pressure in the ear canal equaled that in the tympanic cavity (C_e). The relative compliance of the tympanometry (amplitude of the tympanogram) was 0.65 ml on average, but the individual difference is quite large, varying from the smallest 0.25 ml to the largest 1.61 ml. For the majority (96.1%) of the tested ears, the pressure in the tympanic cavity, as shown by the position of the peak of individual tympanograms, did not exceed ±50 mm H_2O. A new term of compliance ratio (*CR*) is introduced as a measurable parameter to express the gradient of compliance change which is of considerable importance in clinical tympanogram interpretation. *CR* is defined as $\Delta C_{\Delta P}/\Delta C_{200}$ where ΔC_{200} is the overall amplitude of a tympanogram and $\Delta C_{\Delta P}$ is the compliance shift from the peak to a certain point corresponding to a ΔP pressure change. It is proposed to take ±50 and ±100 mm H_2O for ΔP in routine compliance ratio measurement and comparison. *CR* is approximately 0.5 when ΔP is ±50 mm H_2O. (9 refs.)

120862 Auditory illusions, handedness and the spatial environment. D.Deutsch (Dept. of Psychology, Univ. of California, San Diego, La Jolla, CA, USA).
J. Audio Eng. Soc. (USA), vol.31, no.9, p.607-18 (Sept. 1983).
A number of paradoxical illusions occur when two streams of sound emanate simultaneously from different regions of space. Right-handers and left-handers differ statistically in terms of the illusory percepts obtained. The bases for these illusions are examined, and their implications are discussed. (23 refs.)

120863 Auditory illusions and their relation to mechanisms normally enhancing accuracy of perception. R.M.Warren (Dept. of Psychology, Univ. of Wisconsin, Milwaukee, WI, USA).
J. Audio Eng. Soc. (USA), vol.31, no.9, p.623-9 (Sept. 1983).
Some auditory illusions and confusions are discussed, including perceptual restoration of masked sounds (temporal induction), the loss of lateralization of a monaural signal when accompanied by contralateral noise (contralateral induction), and illusory changes in repeated words (verbal transformations). Each of these illusions seems to be caused by processes which act to enhance the accuracy of perception in the noisy environments encountered during everyday life. (21 refs.)

120864 Pitch segregation by interaural phase, by momentary amplitude disparity, and by monaural phase. M.Kubovy, J.E.Daniel (Dept. of Psychology, Rutgers-State Univ. of New Jersey, New Brunswick, NJ, USA).
J. Audio Eng. Soc. (USA), vol.31, no.9, p.630-5 (Sept. 1983).
Pitch segregation is an example of spontaneous auditory perceptual grouping in which one component of a complex is perceptually enhanced, or several are enhanced in turn, forming a tune or scale. Three component manipulations are discussed which produce pitch segregation by (1) altering the apparent location of the component (interaural time disparity); (2) briefly reducing and then restoring the amplitude of the component (momentary amplitude dispar-

ity); or (3) phase shifting one component of a monaural harmonic series (monaural phase disparity). (9 refs.)

120865 Demonstrations of circular components of pitch. R.N.Shepard (Dept. of Psychology, Stanford Univ., Stanford, CA, USA).
J. Audio Eng. Soc. (USA), vol.31, no.9, p.641-9 (Sept. 1983).
Pitch is usually thought of as a one-dimensional psychological attribute corresponding to the one-dimensional physical variable of frequency. However, complex tones can be continuously varied between pitches along at least three different dimensions: (1) a rectilinear dimension of height, (2) a circular dimension of chroma, and (3) a second circular dimension of musical fifths. Accompanying sound demonstrations illustrate each of these three variations including illusions in which a tone that is cyclically shifted around the chroma circle seems to go ever higher in pitch, and in which a tone that is simultaneously shifted in opposite directions in height and chroma seems always to be rising in pitch but is clearly lower at the end than at the beginning. (36 refs.)

120866 Influence of posture on the spatial localization of sound. J.R.Lackner (Dept. of Psychology, Brandeis Univ., Waltham, MA, USA).
J. Audio Eng. Soc. (USA), vol.31, no.9, p.650-61 (Sept. 1983).
The perceptual localization of sound often is thought to depend solely on the pattern of auditory cues at the ears. Evidence is presented that the computation of auditory direction also involves nonauditory information from visual, vestibular, tactile, and proprioceptive sources concerning the spatial configuration of the entire body. Likewise, auditory stimulation can influence the apparent orientation of the body. (25 refs.)

120867 Effect of tinnitus masker noise on speech discrimination in quiet and two noise backgrounds. J.B.Spitzer (Veterans Administration Medical Center, West Haven, CT, USA), B.A.Goldstein, L.G.Salzbrenner, G.Mueller.
Scand. Audiol. (Sweden), vol.12, no.3, p.197-200 (1983).
Use of masking devices is achieving recognition as a means of providing tinnitus relief. While palliative results have been described, possible disruptive consequences have not yet received attention. The present study examined the effects of tinnitus masker noise on speech intelligibility. Twenty young normals listened to NU-6 word lists presented in sound field in quiet white noise, and cocktail party noise backgrounds (S/N=0 dB) with and without a tinnitus masker. Although there was little impairment while wearing the masker in quiet, substantial discrimination loss was observed in the two noise backgrounds. The potential disruption in communication function while wearing a masking device is discussed. (9 refs.)

120868 Latencies of ABR (waves III and V) to binaural clicks: effects of interaural time and intensity differences. H.J.Rosenhamer, C.Holmkvist (Dept. of Audiology, Stockholm, Sweden).
Scand. Audiol. (Sweden), vol.12, no.3, p.201-7 (1983).
Auditory brainstem responses to monoaural clicks and to binaural clicks delivered with interaural time differences of 0.5 and 1 ms (delayed clicks in left ear) and interaural intensity differences (right ear minus left ear) of 0, ±10, ±20, and ±30 dB were recorded bilaterally in 7 normal subjects. Latencies of wave III and wave V were studied as functions of click intensity difference for each of the two time-of-onset differences. As the intensity difference was gradually varied from +30 to −30 dB, the latencies were seen to shift (with constant III-V interval) from those of a monaural right-ear (non-delayed clicks) response to those of a monaural left-ear (delayed clicks) response by 0.5 and 1 ms. In all subjects this shift occurred in the 20-dB interval between equal intensity and 20-dB lagging-click dominance, and almost always most of the shift took place in either of the two 10-dB subintervals. Occasionally double-peaked waves appeared in the 20 dB-interval. Binaural ABRs may become useful for diagnosis in patients with signs of brainstem disorder but the normal-hearing and normal audiometric findings including monaural ABR, as such patients have been found to shift their latencies more slowly with varying interaural intensity difference. (18 refs.)

A microprocessor-controlled audiometer of the Bekesy type for high frequencies, and its use .... See Entry 118337

Long term sleep disturbance due to traffic noise .... See Entry 120793

How do sense organs make sense .... See Entry 120838

Sound levels recorded within the symphony orchestra and risk criteria for hearing loss .... See Entry 120955

High speed tympanometry and ipsilateral middle ear reflex measurements using a computerised impedance meter .... See Entry 120970

Comparison of manual and computer-controlled audiometry using identical procedures .... See Entry 120971

The selection of modulation rates for frequency modulated sound field stimuli .... See Entry 120972

Speech signal presentation to the totally deaf .... See Entry 121051

87.36 SPEECH

(see also 43.70 Speech communication)

Instantaneous voice period measurement for cochlear stimulation .... See Entry 118331

An extraction of information of individuality based on the sense of voice quality .... See Entry 118332

Effect of tinnitus masker noise on speech discrimination in quiet and two noise backgrounds .... See Entry 120867

Noninvasive method for detecting laryngeal narrowing with low-frequency sound .... See Entry 120968

Speech signal presentation to the totally deaf .... See Entry 121051

The difference between a communication aid and a speech prosthesis .... See Entry 121055

87.38 MECHANO- AND CHEMIO-CEPTIONS

(inc. biosonic generation, detection and guidance)

120869 Cranial and phrenic nerve responses to changes in systemic blood pressure. J.A.Salamone, K.P.Strohl, D.M.Weiner, J.Mitra, N.S.Cherniack (Dept. of Medicine, Cleveland Metropolitan General Hospital, Univ. Hospitals of Cleveland, Cleveland, OH, USA).
J. Appl. Physiol. (USA), vol.55, no.1, p.61-8 (July 1983).
Fluctuations in blood pressure could result in a change in respiratory neural output not only to chest wall but also to upper airway muscles. The authors compared the effects of changing systemic blood pressure on the activities of the hypoglossal, recurrent laryngeal, and phrenic nerves in eight paralyzed anesthetized dogs ventilated with 100% O_2, room air, or 7% CO_2 in 93% O_2. During steady-state inhalation of each gas, arterial blood pressure was abruptly lowered by inflating a balloon in the inferior vena cava and was raised by similarly obstructing the descending aorta or by clamping both common carotid arteries. Measurements of peak nerve activity from the moving time average were made for all three nerves at each level of chemical drive before and for the first three-five breaths coincident with the maximal changes in blood pressure. The findings suggest that reflexes initiated by changing baroreceptor activity can result in an uneven distribution of respiratory drive to upper airway and chest wall muscles. (20 refs.)

120870 Recovery of normal topography in the somatosensory cortex of monkeys after nerve crush and regeneration. J.T.Wall, D.J.Felleman, J.H.Kaas.
Science (USA), vol.221, no.4612, p.771-3 (19 Aug. 1983).
After median nerve fibers to glabrous skin on the hands of monkeys were crushed and allowed to regenerate, normal topographical organization was recovered in the representation of the hand in primary somatosensory cortex. Similar recovery of normal cortical organization may underlie the sensory restoration that usually follows nerve crush injury in humans. (9 refs.)

120871 Adaptive changes in the vestibulo-ocular reflex in flatfish are achieved by reorganization of central nervous pathways. W.Graf, R.Baker.
Science (USA), vol.221, no.4612, p.777-9 (19 Aug. 1983).
Flatfish provide a natural model for the study of adaptive changes in the vestibulo-ocular reflex system. During metamorphosis their vestibular and oculomotor coordinate systems undergo a 90° relative displacement. As a result, during swimming movements different types of compensatory eye movements are produced before and after metamorphosis by the same vestibular stimulation. Intracellular staining of central nervous connections in the flatfish with horseradish peroxidase revealed that in postmetamorphic fish secondary horizontal semicircular canal neurons contact vertical eye muscle motoneuron pools on both sides of the brain via pathways that are absent in all other vertebrates studied. (18 refs.)

120872 Ventral posterior thalamic neurons differentially responsive to noxious stimulation of the awake monkey. K.L.Casey, T.J.Morrow (Neurology Res. Labs., Veterans Administration Medical Center, Ann Arbor, MI, USA).
Science (USA), vol.221, no.4611, p.675-7 (12 Aug. 1983).
Of 76 cutaneously activated neurons recorded from the ventral posterior thalamus of awake, behaving monkeys, nine were weakly excited by innocuous skin stimulation and responsed maximally only when noxious mechanical cutaneous stimuli were developed within small, contralateral receptive fields. These results show that neurons capable of encoding the spatial and temporal features of noxious stimuli are located in the ventral posterior thalamus of the awake primate. (19 refs.)

Motility and mechanosensitivity of macrocilia in the ctenophore Beroe .... See Entry 120818

How do sense organs make sense .... See Entry 120838

Model interpretation of visual-vestibular interaction in patients with labyrinthine and cerebellar pathologies .... See Entry 120846

An activity meter .... See Entry 121081

87.40 BIOMAGNETISM

(inc. magnetocardiography)

A new magnetic method for studying the quality of lung-retained dust in vivo .... See Entry 120975

Diagnostic potential of magneto-photoacoustic spectroscopy .... See Entry 120976

Nuclear magnetic resonance blood flow measurements in the human brain .... See Entry 120981

87.45 BIOMECHANICS, BIORHEOLOGY, BIOLOGICAL FLUID DYNAMICS

120873 Influence of torque and limb speed on power production in isokinetic exercise. L.R.Osternig (Dept. of Phys. Education, Univ. of Oregon, Eugene, OR, USA), J.Hamill, J.A.Sawhill, B.T.Bates.
Am. J. Phys. Med. (USA), vol.62, no.4, p.163-71 (Aug. 1983).
Power has not often been the focus of attention in the determination of specific loads and velocities for rehabilitative and conditioning exercises. The purpose of this study was to determine the relative influence of torque and limb speed on power production in isokinetic exercise. Voluntary maximum torque values from the quadriceps muscle groups of 10 male college athletes were recorded on an isokinetic dynamometer. Dynamic leg extensor torque and power from the preferred limb were measured at six joint positions through a range of 70-20° of knee flexion and at eight velocities ranging from 50-400°/sec. The data obtained suggested that rehabilitative and conditioning exercises at faster isokinetic speeds may be more effective than slower speeds for power production. Since the position at which peak torque occurs may vary with speed of motion, these data underscore the importance of analyzing maximal values at specific joint angles across speeds in addition to the peak values generated throughout a joint range. (12 refs.)

120874 Electrogoniometry of post-surgical knee bracing in running. K.M.Knutzen (Dept. of Phys. Education, Western Washington Univ., Bellingham, WA, USA), B.T.Bates, J.Hamill.
Am. J. Phys. Med. (USA), vol.62, no.4, p.172-81 (Aug. 1983).
The dynamic range of motion at the knee was compared for two knee braces worn during overground running. Six adult volunteers aged 22 to 28 were used as subjects. All subjects had a surgically repaired knee, a healthy contralateral knee, and were wearing the same type of derotation brace prescribed by their physician. Subjects ran through an experimental area at a slow running pace with the CARS-UBC electrogoniometer strapped to one limb. Three orthogonal potentiometers placed at the knee joint allowed the simultaneous collection of flexion-extension, inward and outward rotation, and varus-valgus motion parameters. Subjects completed five trials at each of four conditions; namely, healthy knee, surgically repaired knee, surgical knee fitted with an elastic support brace, and surgical knee fitted with a derotation brace. Results showed that the derotation brace had a general restraining effect on internal-external rotation of the surgically repaired knee. For all subjects, internal rotation was reduced by 22 percent and external rotation reduced by 31 percent. There was also an 11 percent reduction in the flexion-extension range of motion while subjects wore the derotation brace. The elastic support brace did not reduce any range of motion parameters. (11 refs.)

120875 The muscular blood flow in healthy persons of different age. O.V.Korkushko, K.G.Sarkisov, V.E.Fraifel'd.
Med. Radiol. (USSR), vol.28, no.9, p.39-42 (Sept. 1983). In Russian.
A study was made of the muscular blood flow at rest (MBFR) and in reactive hyperemia in 170 healthy persons using a method of local clearance with ^{133}Xe. The results of the study showed a regular decrease in the MBFR

and maximum muscular blood flow (MMBF) level in aging, the decrease rates of MMBF considerably prevailing over those of MBFR. In the age interval between 18-96 MBFR lessens by 24%, MMBF more than twice. The age-associated time course of MMBF is of a more complicated nature as compared to that of MBRF and indicates a considerable reduction of the functional reserves of the tissue blood flow in the skeletal muscles of middle-aged and old persons. The above data make it possible to outline MBFR rough standard values: for young persons—2.5-5.0 ml/100 g/min., for older persons—1.5-3.5 ml/100 g/min. (9 refs.)

120876 Pressures during retrograde pyelography. H.S.Thomsen (Univ. of Copenhagen, Herlev, Denmark).
Acta Radiol. Diagn. (Sweden), vol.24, no.2, p.171-5 (1983).
Model experiments were conducted to simulate the conditions of injection rate and pressure during retrograde pyelography. Pressures at the upper and lower end of a Ch. 5 and Ch. 6 ureteral catheter were determined with 30% and 45% sodium meglumine diatrizoate and water and with different needles allowing leakage of the injected medium from a reservoir at the upper end of the catheter. It is concluded that the pressure at the upper end of the catheter may be kept within physiologic range if (1) the contrast medium is injected slowly, (2) the contrast medium leaks back around the ureteral catheter into the bladder and (3) a contrast medium with a low viscosity is used. It is advisable to use a Ch. 5 ureteral catheter instead of a Ch. 6 for retrograde pyelography. (16 refs.)

120877 Relationship between length and strength in heart muscle. Electromechanical coupling on deformation of the myocardium. V.Ya.Izakov, Yu.L.Protsenko (Sverdlovsk Res. Inst. of Labour Hygiene & Occupational Diseases, Sverdlovsk, USSR).
Biophysics (GB), vol.27, no.5, p.925-31 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.5, p.880-5 (1982). [received: Sept. 1983]
The method of current clamping in a sucrose bridge on the myocardium of the frog atrium and ventricle and the rabbit papillary muscles has been used to study the effect of the initial length of the preparations on the phasic and tonic components of the mechanical response. It has been established that stretching shifts the curves current-strength against amplitude of mechanical response to the region of lower values of depolarizing current. The ratio of the phasic and tonic components depends on the initial length of the myocardium. It is assumed that the link between length and strength as well as change in the degree of overlap of the filaments of the contractile proteins is based on change in the membrane potential of the surface membrane of the myocytes and additional calcium activation. (16 refs.)

120878 An estimate of the stress-field in an osseous medium having a no-slip interface crack. J.C.Misra, V.V.T.N.Murty (Dept. of Maths., Indian Inst. of Technol., Kharagpur, India).
Eng. Fract. Mech. (GB), vol.18, no.6, p.1075-86 (1983).
A study of the stress-field in the vicinity of a no-slip interface crack in an osseous medium is presented. The study is based on the use of a mathematical model concerning adhesive fracture mechanics at a bimaterial interface. The solution is motivated by problems in artificial human joints in which the artificial material forming the articulating surface is connected to bone by a polymeric material, e.g. polymethyl-methacrylate (PMMA). Linear viscoelasticity of bones (in conformity to experimental observations) is accounted for in the analysis. Starting with the differential operator representations of constitutive relations and using integral transform techniques, the problem is reduced to that of finding the solution of a set of coupled integral equations. Quantities of physical interest are obtained numerically by using experimentally determined values of various physical constants involved in the analysis. (13 refs.)

120879 Expiratory flow limitation. R.E.Hyatt (Dept. of Physiology & Biophys., Mayo Clinic & Mayo Found., Rochester, MN, USA).
J. Appl. Physiol. (USA), vol.55, no.1, p.1-7 (July 1983).
The first major advance in understanding expiratory flow limitation of the lungs came with the description of isovolume pressure-flow curves. These curves documented the existence of a volume-dependent limit to maximal expiratory flow and led directly to the description of the maximal expiratory flow-volume (MEFV) curve. Definitive modeling of flow limitation awaited the description of a localized mechanism that dominated the flow-limiting process. The phenomenon of wave speed limitation of flow was shown to apply to the airways and provided the needed localized mechanism. Using this concept and recent data on airway mechanics and the frictional losses in the flow, a computational model of the MEFV curve has been developed. Further progress will require modeling of inhomogeneous emptying in diseased lungs, perfecting noninvasive techniques of estimating pertinent airway characteristics, and improving techniques for increasing the signal-to-noise ratio in MEFV curves. (47 refs.)

120880 Force reserve of the diaphragm in patients with chronic obstructive pulmonary disease. F.Bellemare, A.Grassino (Notre Dame Hospital, Univ. of Montreal, Montreal, Quebec, Canada).
J. Appl. Physiol. (USA), vol.55, no.1, p.8-15 (July 1983).
The fatigue threshold of the human diaphragm in normal subjects corresponds to a transdiaphragmatic pressure (Pdi)-inspiratory time integral (TTdi) of about 15% of Pdi_{max}. The TTdi of resting ventilation was measured in 20 patients with chronic obstructive pulmonary disease (COPD) and ranged between 1 and 12% of Pdi_{max} (mean 5%). TTdi was significantly related to total airway resistance ($r=0.57$; $P<0.05$). It is concluded that (1) the force reserve of the diaphragm in COPD patients is decreased because of a decrease in Pdi_{max}; (2) the remaining force reserve of the diaphragm can be exhausted by even minor modifications in the breathing pattern; and (3) at a T_I/T_T (ratio of inspiratory time to total cycle duration) of 0.40 the COPD patients can increase their mean Pdi 3-fold before reaching a fatiguing pattern of breathing compared with 8-fold in normal subjects. (21 refs.)

120881 Parametric estimation of ventilation-perfusion ratio distributions. W.E.Stewart, S.M.Mastenbrook,Jr. (Dept. of Chem. Engng. & Preventive Medicine, Univ. of Wisconsin, Madison, WI, USA).
J. Appl. Physiol. (USA), vol.55, no.1, p.37-51 (July 1983).
Presents a model and rigorous statistical approach for recovery of ventilation-perfusion ratio (V/Q) distribution parameters from multiple inert gas elimination data. The authors model the lung as a parallel combination of shunt, dead space, and one to three log-normal distributions of gas exchange units. This model provides a natural set of parameters for characterizing V/Q distributions. The log-normal terms are adjustable to represent smooth or sharp peaks in the distribution. Since the peak locations and widths are explicit in the model, very few parameters are needed. The authors select and estimate the significant parameters of the model by use of standard statistical tests and constrained least squares. This method provides two major advances in V/Q distribution estimation: (1) it allows flexible pooling and statistical comparisons of multiple experiments, and (2) it simultaneously gives both point estimates and 95% probability intervals for the V/Q distribution parameters. The authors present results of their procedure for data from humans in health, stress, and pulmonary disease. A program package, VQPAR, in FORTRAN is available for implementing the procedure. (30 refs.)

120882 Cardiac output and skin blood flow in lean and obese individuals during exercise in the heat. N.B.Vroman, E.R.Buskirk, J.L.Hodgson (Lab. for Human Performance Res., Pennyslvania State Univ., University Park, PA, USA).
J. Appl. Physiol. (USA), vol.55, no.1, p.69-74 (July 1983).
Five obese (% body fat ≥27%) and five relatively lean (%body fat<20%) men performed upright exercise on a cycle ergometer at intensities of 30, 50, and 70% of their maximal aerobic power [$V(O_{2max})$ (ml.kg fat-free $wt.^{-1}.min^{-1}$] in both a thermoneutral [dry bulb temperature (T_{db})=22°C, wet bulb temperature (T_{wb})=14°C] and a hot (T_{db}=38°C, Twb=20°C) ambient environment. Cardiac output (Q) was measured by CO_2 rebreathing and forearm blood flow (FBF) was measured by venous occlusion plethysmography. Esophageal temperature (T_{es}) was measured by a thermocouple placed in the esophagus at approximately heart level, and mean skin temperature ($\bar{T}_{sk}$) was calculated from the average of thermocouple readings from six skin sites. It was concluded that body composition may alter the balance between the two opposing sets of cutaneous vascular reflexes (baroreceptor-induced vasoconstriction and thermoregulatory vasodilation) that regulate the competition for blood flow between the skin and working muscle during exercise in the heat. (28 refs.)

120883 Effect of granulocyte depletion on altered lung mechanics after endotoxemia in sheep. J.M.Hinson,Jr., A.A.Hutchison, M.L.Ogletree, K.L.Brigham, J.R.Snapper (Pulmonary Circulation Center, School of Medicine, Vanderbilt Univ., Nashville, TN, USA).
J. Appl. Physiol. (USA), vol.55, no.1, p.92-6 (July 1983).
To examine the role of circulating granulocytes in the airway changes caused by endotoxemia, the authors measured the response of chronically instrumented unanesthetized sheep to endotoxemia before and after granulocyte depletion with hydroxyurea. Granulocyte depletion did not affect the increases in mean pulmonary arterial pressure caused by endotoxin [peak pressure 59±8 cmH_2O±(SE) control, 51±8 cmH_2O granulocyte depleted]. However, the early (30-60 min after endotoxin) airway response to endotoxemia was markedly attenuated. Without granulocyte depletion, endotoxin caused dynamic compliance (Cdyn) to decrease to 41±10% of the base-line value and total lung resistance (RL) to increase to 283±61% of base line. When animals were granulocyte depleted, endotoxin decreased Cdyn to 69±6% ($P<0.05$) of base line and increased RL to 141±20% of base line ($P<0.05$). It is concluded that interaction of granulocytes with the lung contributes to the changes in lung mechanics observed following endotoxemia and that the early pulmonary hypertension and the early alterations in lung mechanics caused by endotoxemia are caused by separate processes. (27 refs.)

120884 Deposition of aerosol particles and flow resistance in mathematical and experimental airway models. C.S.Kim, L.K.Brown, G.G.Lewars, M.A.Sackner (Dept. of Medicine, Mount Sinai Medical Center, Miami Beach, FL, USA).
J. Appl. Physiol. (USA), vol.55, no.1, p.154-63 (July 1983).
Aerosol deposition and flow resistance in obstructed airways were determined from five mathematical and experimental airway models. The first three models were theoretical and based upon Weibel's (1963) symmetrical lung model with (1) uniform reduction of airway diameter in various groups of airway generations; (2) obstruction of a few major airways such that a severe uneven flow distibution occurs in the lung; (3) focal constriction of selected large airways. In model 3, an empirical formula was utilized to assess deposition and resistance in the constricted airways. The remaining two models were tested experimentally: (4) oscillation of a compliant wall in a straight tube and (5) two-phase gas-liquid flow utilizing human sputum in a rigid branching tube. In models 1, 2, and 3, airway resistance increased to a greater extent than did the increase of aerosol deposition except when small airways were obstructed in model 1. Here, the increase of aerosol deposition was slightly higher than the rise in airway resistance. A sharp increase of aerosol deposition with a minimal increase of flow resistance was demonstrated in models 4 and 5. These data indicate that aerosol deposition may be a more sensitive indicator of airway abnormalities than overall airway resistance in small airways obstruction, during oscillation of large and medium airway walls, and when excessive secretions within the airways move with a wave or slug motion. (35 refs.)

120885 Active and passive respiratory mechanics and control of breathing in kittens. W.A.Zin, D.Marlot, M.Bonora, N.M.Siafakas, H.Gautier, J.Milic-Emili (Meakins-Christie Labs., McGill Univ., Montreal, Quebec, Canada).
J. Appl. Physiol. (USA), vol.55, no.1, p.183-90 (July 1983).
In five spontaneously breathing kittens (12-13 days old), anesthetized with pentobarbital sodium, the authors measured the passive and active elastances and resistances of the respiratory system and the decay of inspiratory muscle pressure ($Pmus_I$) during expiration. When normalized for body weight (BW), passive resistance (Rrs.BW) was smaller in kittens than in adult cats, whereas passive elastance (Ers.BW) did not differ significantly. As a result, passive time constant ($\tau rs=Rrs/Ers$) was shorter in kittens (mean ±SE: 0.073±0.011 s) than in cats (0.121±0.008 s). This, associated with a faster decay in $Pmus_I$ in kittens, results in 2-3 times higher flows per kilogram body weight during spontaneous tidal expirations in kittens than in cats. As in the adult cats, the average values of active elastance and resistance were higher than the passive, the average percentage increase amounting to 59 and 49%, respectively. The greater active impedance reflects force-length and force-velocity properties of inspiratory muscles. Its price is higher work of breathing; its advantage is greater intrinsic load compensation. (17 refs.)

120886 Effect of temperature on the contractile properties and muscle power of triceps surae in humans. C.T.M.Davies, K.Young (Dept. of Physiology & Pharmacology, Univ. of Nottingham Medical School, Nottingham, England).
J. Appl. Physiol. (USA), vol.55, no.1, p.191-5 (July 1983).
The effects of heating and cooling on the electrically evoked mechanical and contractile properties of the triceps surae in relation to the maximal dynamic performance of the leg muscles during cycling and vertical jumping have been examined in five healthy male subjects. A mean rise of 3.1°C in muscle temperature (T_m) was associated with a decrease in time to peak tension (TPT) and half-relaxation time ($^1/_2RT$) but was without effect on twitch (P_{tO}) and tetanic tension at 20 Hz (P_{O20}) and 40 Hz (P_{O40}) and maximal voluntary contraction (MVC). Reducing T_m by 8.4°C had the opposite effect on TPT and $^1/_2RT$ and produced a fall in P_{tO}, P_{O40}, and MVC. The peak power output during cycling ($\dot{W}_1$) and jumping ($\dot{W}$) was linearly related to T_m as well as negatively associated with TPT. The best single guide to $\dot{W}$ and $\dot{W}_1$ was given by a ratio of MVC to TPT: $\dot{W}(W)=626.5+79.04$ (MVC/TPT)(N/ms; $r=+0.82$) and $\dot{W}_1(W)=1342+84.9$ (MVC/TPT)(N/ms; $r=+0.87$). The results underline the importance of the contractile and force generating capacity of human muscle in determining

maximal power output and performance during exercise of a few seconds' duration. (22 refs.)

120887 Mammalian tracheal dimensions: scaling and physiology. D.E.Leith (Brigham & Women's Hospital, Harvard Medical School, Boston, MA, USA).
J. Appl. Physiol. (USA), vol.55, no.1, p.196-200 (July 1983).
Mammalian tracheal dimensions vary with body mass in a way which suggests that expiratory flow limitation, inertance, and resistance are dominant constraints on tracheal design, rather than dead space or minimum work or effort. The fraction of total resistance attributable to the trachea appears to be about the same regardless of body size. Tracheal inertance appears to vary with body mass to the $-^1/_2$ power, so that inertial pressures, like elastic and resistive pressures, are invariant with body size and natural frequency, like respiratory frequency, varies with body mass to the $-^1/_4$ power. Other dominant constraints on tracheal design may include clearance functions and specialized habitat or behavior. (21 refs.)

120888 Pulmonary blood flow and tissue volume: model analysis of rebreathing estimation methods. G.M.Burma, G.M.Saidel (Dept. of Biomedical Engng., Case Western Reserve Univ., Cleveland, OH, USA).
J. Appl. Physiol. (USA), vol.55, no.1, p.205-11 (July 1983).
As the basis for comparing rebreathing methods of estimating pulmonary blood flow ($\dot{Q}$) and tissue-capillary volume (Vtc), the authors use a dynamic mass-balance model for gas species having different physicochemical properties (e.g. He, CO, C_2H_2). The model accounts for the effects of ventilation and perfusion inhomogeneities, breathing pattern variation, lung and rebreathing-bag volumes, and recirculation. Also, the authors examine the variability of the estimates caused by random error. In addition to analyzing two well-known methods, they show how an appropriate synthesis of these methods can lead to improved estimates. (15 refs.)

120889 Power output and fatigue of human muscle in maximal cycling exercise. N.McCartney, G.J.F.Heigenhauser, N.L.Jones (Dept. of Medicine, McMaster Univ. Health Sci. Centre, Hamilton, Ontario, Canada).
J. Appl. Physiol. (USA), vol.55, no.1, p.218-24 (July 1983).
Maximal torque-velocity relationships and fatigue were studied during short-term maximal exercise on a constant velocity cycle ergometer in 13 healthy male subjects. Maximum torque showed an inverse linear relationship to crank velocity between 60 and 160 rpm, and a direct relationship to thigh muscle volume measured by computerized tomography. Peak torque per liter thigh muscle volume (PT, $N.ml^{-1}$) was related to crank velocity (CV, rpm) in the following equation: $PT=61.7-0.234$ CV ($r=0.99$). Peak power output was a parabolic function of crank velocity in individual subjects, but maximal power output was achieved at varying crank velocities in different subjects. Fiber type distribution was measured in the two subjects showing the greatest differences and demonstrated that a high proportion of type II fibers may be one factor associated with a high crank velocity for maximal power output. The decline in average power during 30 s of maximal effort was least at 60 rpm (23.7±4.6% of initial maximal power) and greatest at 140 rpm (58.7±6.5%). At 60 rpm the decline in power over 30 s was inversely related to maximal oxygen uptake ($ml.min^{-1}.kg^{-1}$) ($r=0.69$). Total work performed and plasma lactate concentration 3 min after completion of 30-s maximum effort were similar for each crank velocity. (29 refs.)

120890 End-expiratory level and breathing pattern in the newborn. G.B.Griffiths, A.Noworaj, J.P.Mortola (Dept. of Physiology, McGill Univ., Montreal, Quebec, Canada).
J. Appl. Physiol. (USA), vol.55, no.1, p.243-9 (July 1983).
In newborn mammals, the resting position of the respiratory system (V_R) is small due to a relatively high chest wall-to-lung compliance ratio. In dynamic conditions several indications suggest that the end-expiratory level functional residual capacity (FRC) is maintained above V_R. From the experiments described the authors conclude that in the puppy or larger species, including infants, who have a similar respiratory system time constant (τ) and a smaller breathing rate than the puppy, the breathing pattern alone does not explain the FRC-V_R difference. The rise in FRC must therefore result from the parallel action of mechanisms braking the expiratory flow, such as postinspiratory muscle activity and narrowing of the vocal cords. However, in the fastest breathing animals, such as the newborn rat, the breathing pattern alone may yield a more important elevation of FRC, even during tidal respiration. (21 refs.)

120891 Canine blood volume and cardiovascular function during hyperthermia. K.Miki, T.Morimoto, H.Nose, T.Itoh, S.Yamada (Dept. of Physiology, Kyoto Prefectural Univ. of Medicine, Kyoto, Japan).
J. Appl. Physiol. (USA), vol.55, no.2, p.300-6 (Aug. 1983).
The effect of acute hyperthermia on hemodynamic functions and blood volume regulation was examined on eight splenectomized dogs. Elevation of core body temperature by 2°C over 90 min caused significant increase in cardiac output (11.2±12.5 $ml.min^{-1}.kg^{-1}$ or about 10%) and significant decrease in total peripheral resistance (TPR; −1.3±1.0 $mmHg.s.ml^{-1}$ or about 20%), whereas blood volume (BV), plasma oncotic pressure, and intravascular protein mass remained unchanged. Thus the raised core temperature caused peripheral vasodilation with decreased TPR and compensatory increase in cardiac output. Because BV remained unchanged during warming, mobilization of extravascular fluid did not occur; only the redistribution of blood to the vasodilated cutaneous circulation took place. To assess the effects of heat stress on transvascular fluid equilibrium, Ringer solution (10.7 $ml.kg^{-1}.10\ min^{-1}$) was infused under normothermic and hyperthermic conditions. The volume of fluid retained within the intravascular space under equilibrium state was 33.5% in hyperthermia and 9.4% in normothermia. In hyperthermia, the transvascular fluid shift and urinary output were decreased both during and after infusion. The role of preferential fluid retention within the intravascular space observed during hyperthermia was discussed in relation to the mechanism to maintain cardiovascular function and BV under heat stress. (19 refs.)

120892 Mechanical properties of the upper airway. M.Cauberghs, K.P.van de Woestijne (Lab. voor Longfunktieonderzoek, Acad. Ziekenhuis St. Rafael, Leuven, Belgium).
J. Appl. Physiol. (USA), vol.55, no.2, p.335-42 (Aug. 1983).
The series and shunt components of the impedance of the upper airway (Zuaw) were evaluated from measurements obtained during a Valsalva maneuver by means of a modified forced oscillation technique. When the cheeks are supported, the upper airway can be represented by a single distributed transmission line. The homogeneity of this line was confirmed by measuring separately Zuaw and the impedance of the mouth. Correction of the impedance of the respiratory system, determined by means of the forced oscillations technique, for the shunt properties of Zuaw results in some modifications of the frequency dependence of resistance (Rrs) in healthy adults and in marked changes of the absolute values of Rrs in children and in patients with obstructive lung disease. (13 refs.)

120893 Influence of chest wall distortion on esophageal pressure. P.N.LeSouef, J.M.Lopes, S.J.England, M.H.Bryan, A.C.Bryan (Res. Inst., Hospital for Sick Children, Toronto, Ontario, Canada).
J. Appl. Physiol. (USA), vol.55, no.2, p.353-8 (Aug. 1983).
The caudocephalad profile of esophageal pressure swings was studied in 10 preterm and 5 full-term infants, and the effect of chest wall distortion on esophageal pressure swings was analyzed in 12 preterm infants. Esophageal pressure was measured with a fluid-filled catheter, tidal volume with a pneumotachograph, mouth pressure with a face mask and pressure transducer, and rib cage and abdominal motion with magnetometers. In preterm infants the profile of esophageal pressure swings fell very steeply in the caudocephalad direction. In full-term infants it was flat during quiet sleep and steep during rapid-eye-movement sleep. When breaths, standardized for pleural pressure, were compared between a period with maximal and a period with minimal chest wall distortion, esophageal pressure swings for both spontaneous and occluded breaths were higher in the former period. It concluded that the compliant preterm rib cage results in an uneven distribution of pleural pressure and that this distribution varies with changes in chest wall distortion. Esophageal pressure measurements are therefore an unreliable estimate of mean pleural pressure in the preterm infant and can be unreliable in the term infant. (23 refs.)

120894 Effect of chest wall distortion on occlusion pressure and the preterm diaphragm. P.N.LeSouef, J.M.Lopes, S.J.England, M.H.Bryan, A.C.Bryan (Res. Inst., Hospital for Sick Children, Toronto, Ontario, Canada).
J. Appl. Physiol. (USA), vol.55, no.2, p.359-64 (Aug. 1983).
The effect of chest wall distortion (CWD) on transdiaphragmatic pressure (Pdi) and/or mouth pressure during end-expiratory airway occlusions was studied in seven preterm infants. The authors measured mouth occlusion pressure (Pmo) with a face mask and pressure transducer, gastric pressure (Pga) with a fluid-filled catheter, diaphragmatic electromyogram (Edi) using surface electrodes, and rib cage and abdominal motion using magnetometers. They reasoned that $Pdi=Pmo-Pga$ on airway occlusion. Periods with maximal and periods with minimal CWD were compared. They found that (1) when CWD was minimal, an increase in Edi produced an increase in Pmo or Pdi in four infants; (2) when breaths were in the same Pmo of Pdi from each period in each infant were compared, those from the period with greatest CWD had an increased Edi (mean increase 76%, $P<0.005$, and 144%, $P<0.01$, for Pmo and Pdi, respectively). It is concluded that in preterm infants, Pmo can be a poor indicator of respiratory drive, and CWD markedly limits the effectiveness of the diaphragm as a force generator. (24 refs.)

120895 Esophageal pressure in infants at elevated lung volumes and positive airway pressure. C.S.Beardsmore, J.Stocks, M.Silverman (Dept. of Paediatrics & Neonatal Medicine, Univ. of London, London, England).
J. Appl. Physiol. (USA), vol.55, no.2, p.377-82 (Aug. 1983).
The measurement of esophageal pressure changes (ΔPes) under conditions of elevated lung volume or continuous positive airway pressure (CPAP) was investigated in a group of 17 infants by use of an esophageal balloon. Eleven of the infants were studied in a whole-body plethysmograph, and lung volume was increased by a volume injection technique. Reproducible measurements of lung volume in the plethysmograph showed that changes in mask pressure (ΔPm) were accurate during airway occlusion in 10 of the 11 infants. A progressive elevation of the ratio ΔPes/ΔPm during respiratory efforts against occlusion at lung volumes above the tidal range was observed in 8 of the 11 infants. In only one of these infants could the error have been in ΔPm measurement. Of seven infants (including one common to both studies) studied under CPAP, six also showed this effect, which occurred predominantly in very young or preterm infants. Changes in esophageal pressure in infancy, measured at high lung volumes or pressures, may not be representative of mean pleural pressure changes. (20 refs.)

120896 Effects of phrenic stimulation on upper airway resistance in anesthetized dogs. S.B.Gottfried, K.P.Strohl, W.van de Graaff, J.M.Fouke, A.F.diMarco (Dept. of Medicine, Cleveland Metropolitan General Hospital, Cleveland, OH, USA).
J. Appl. Physiol. (USA), vol.55, no.2, p.419-26 (Aug. 1983).
The effects of changes in the balance of forces, produced by chest wall and upper airway muscle contraction on upper airway patency, was evaluated in 10 spontaneously breathing anesthetized dogs. Bilateral phrenic nerve stimulation was performed in-phase and out-of-phase with spontaneous upper airway muscle contraction, while inspiratory upper airway resistance was monitored as an index of airway patency. The findings show that a mismatch in the activation of the upper airway and chest wall muscles is a major factor predisposing to airway occlusion. The authors suggest that such a mismatch will change upper airway resistance depending on airway size, geometry, or compliance. In formation concerning how electrical activation of upper airway muscle changes these mechanical aspects of the upper airway would be crucial in gaining greater understanding of the way upper airway patency is maintained during normal breathing. In addition, the region of the hyoid arch appears to be a vulnerable region for increased flow resistance in the upper airway. (32 refs.)

120897 Regional medullary blood flow during isocapnic hyperpnea in anesthetized cats. J.A.Neubauer, D.A.Strumpf, N.H.Edelman (Dept. of Medicine, Univ. of Medicine & Dentistry of New Jersey, New Brunswick, NJ, USA).
J. Appl. Physiol. (USA), vol.55, no.2, p.447-52 (Aug. 1983).
This study was performed to test the hypothesis that an increase in the activity of medullary respiratory neurons, which is not associated with change in arterial blood gas tensions, results in an increase in the blood flow within the medulla. The authors studied 12 anesthetized cats during isocapnic hyperpnea induced by either electrical simulation of hindlimb muscle groups (change in minute ventilation equalled 220%) or by carotid sinus nerve stimulation (change in peak phrenic activity.min^{-1} equalled 180%). Changes in total brain blood flow and in ventral and dorsal medullary blood flow were measured using the radioactive microsphere (15 μm) technique. In each cat measurements were made both before and after isocapnic hyperpnea had been sustained for 4 min. The data obtained indicate that stimulation of respiratory motor neurons without change in arterial blood composition enhances perfusion of the ventral medulla. The finding suggests that motor neuron stimulation is accompanied by a substantial increase in metabolic rate of the ventral medulla with release of metabolic products which mediate the vasodilation. These metabolic products could also act as positive feedback stimuli for the central chemoreceptor. (28 refs.)

120898 Effect of a hydrostatic pleural pressure gradient on mechanical behavior of lung lobes. B.G.Murphy, F.Plante, L.A.Engel (Meakins-Christie Labs., McGill Univ., Montreal, Quebec, Canada).
J. Appl. Physiol. (USA), vol.55, no.2, p.453-61 (Aug. 1983).
Using ^{133}Xe, the vertical distribution of regional volume (Vr) was measured in three regions of excised canine lobes both in air and when completely submerged in saline at 40, 60, 70, and 80% lobar vital capacity (VC). The estimated pleural pressure gradient, derived from values of Vr, distance bet-

ween regions, and the lobar pressure-volume (PV) curve, underestimated the true gradient by 45%. Conversely, the gradient of Vr was substantially less than predicted. From the mean depth of each region below the waterline, pleural, and hence transpulmonary pressure (PL) was computed. The values of Vr-PL points on the lobar PV curve to corresponding Vr-PL points in submerged lobes represent an effective regional compliance of a lobe undergoing deformation. With one exception this was less than the corresponding homogeneous compliance, indicating a stiffening of the lobe during deformation. (20 refs.)

120899 Gas transport during high-frequency ventilation. V.Brusasco, T.J.Knopp, K.Rehder (Dept. of Anesthesiology & Physiology & Biophys., Mayo Clinic, Rochester, MN, USA).
J. Appl. Physiol. (USA), vol.55, no.2, p.472-8 (Aug. 1983).
During high-frequency small volume ventilation (HFV), the transport rate of gas from mouth to a lung region is a function of two conductances: regional longitudinal gas conductance along the airways (Gr_{longi}) and gas conductance between lung regions (G_{inter}). Gr_{longi} per unit regional lung (gas) volume [$Gr_{longi}/(Vr\beta g)$] was determined during HFV in 11 anesthetized paralyzed dogs, lying supine. The i distribution of $Gr_{longi}/(Vr\beta g)$ was nearly uniform during HFV when stroke volumes were less than approximately two-thirds of the Fowler dead-space volume. By contrast, the distribution of $Gr_{longi}/(Vr\beta g)$ was nonuniform when the stroke volume exceeded approximately two-thirds of the Fowler dead-space volume and the oscillation frequency was 5 Hz. Gas conductance along the airways per unit lung gas volume [average $G_{longi}/(V\beta g)$], for the entire lung, increased with stroke volume at all frequencies, but for a given product of oscillation frequency and stroke volume, the average $G_{long}Di/(V\beta g)$ increased with frequency up to a maximal value; the frequency at which the maximum occurred on the kinematic viscosity of the inspired gas mixture. (9 refs.)

120900 Mechanical and gas-distribution behavior of a collateral ventilation model. A.G.Cutillo, C.H.Durney, A.D.Renzetti,Jr. (Dept. of Internal Medicine, Univ. of Utah, Salt Lake City, UT, USA).
J. Appl. Physiol. (USA), vol.55, no.2, p.503-11 (Aug. 1983).
The theoretical analysis of A.B. Otis et al. (ibid., vol.8, p.427-43, 1956) was extended to study the effects of collateral ventilation on lung mechanics and gas distribution. Equations were developed to express the effective compliance, the effective resistance, and the distribution of airflow and tidal volume in a two-compartment model incorporating a collateral communication. The analysis of the model showed that, in general, collateral ventilation tends to attenuate the degree of frequency dependence of compliance and resistance, the magnitude of this effect being dependent on the mechanical properties of the model, including collateral resistance. The present theoretical data suggest that the use of equations based on a model incorporating collateral ventilation is justified, at least in predicting the mechanical and gas-distribution behavior of the lung in emphysema. (19 refs.)

120901 A model of inspiratory muscle mechanics. P.T.Macklem, D.M.Macklem, A.de Troyer (Meakins-Christie Labs., McGill Univ. Clinic, Royal Victoria Hospital, Montreal, Quebec, Canada).
J. Appl. Physiol. (USA), vol.55, no.2, p.547-57 (Aug. 1983).
The diaphragm may be modelled pneumatically or electrically as two generators or pumps in series between the lung and abdomen. As such, the force developed by diaphragmatic contraction is the sum of the forces developed in each part, whereas the volume displaced is the same for each part and equal to the total volume displaced. The coastal part of the diaphragm is in series with the intercostal and accessory (IA) muscles between the lung and RC, whereas the crural part is in parallel. The volume displaced by simultaneous contraction of the crural part and IA is the sum of volumes displaced by each part. The action of pleural and abdominal pressure [acting through the area of apposition (Aap) of the diaphragm to RC] can be modelled as a summing junction between IA and RC. With hyperinflation the costal part acts more and more in parallel with both IA and the crural part, whereas Aap diminishes, so that the ability to develop large forces decreases independently of the muscles' force-length relationships. (14 refs.)

120902 Simultaneous quantitation of knee ligament forces. E.P.France, A.U.Daniels, E.M.Goble, H.K.Dunn (Orthopedic Bioengng. Lab., Univ. of Utah Coll. of Medicine, Salt Lake City, UT, USA).
J. Biomech. (GB), vol.16, no.8, p.553-64 (1983).
An apparatus and experimental technique have been developed which allow the simultaneous quantitation of human cadaver knee ligament forces with the knee in various positions and subjected to various loads. The methodology permits all the major ligaments of the knee to be kept intact, thus preserving much of their normal relative load-bearing function. A novel measurement technique was employed for ligament force measurement. Strain gauges were placed at the ligamentous insertions and origins either on cortical bone or the cancellous/cortical transition. Gauge output was subsequently calibrated quantitatively by cutting the ligaments and subjecting them to known loads. The gauging technique was thermally stable, and the method as a whole yielded reproducible relative ligament force data when knee positions and loads were repeated for a given knee specimen. Three fresh human cadaver knee specimens have been subjected to testing thus far with gauges at six ligamentous sites. (16 refs.)

120903 Bone stress in the horse forelimb during locomotion at different gaits: a comparison of two experimental methods. A.A.Biewener (Museum of Comparative Zoology, Harvard Univ., Cambridge, MA, USA), J.Thomason, A.Goodship, L.E.Lanyon.
J. Biomech. (GB), vol.16, no.8, p.565-76 (1983).
Longitudinal stresses acting in the cranial and caudal cortices of the radius and the dorsal and palmar cortices of the metacarpus in the horse were determined using two independent methods simultaneously. One approach involved the use of rosette strain gauges to record in vivo bone strain; the other involved filming the position of the horse's forelimb as it passed over a force plate. Agreement between the two analyses was better for the radius than for the metacarpus. Both methods showed the radius to be loaded primarily in sagittal bending, acting to place the caudal cortex in compression and the cranial cortex in tension. At each gait the magnitude of peak stress in each cortex based on the film/force analysis was 1.5-2 times higher than that determined from the bone strain recordings. In the metacarpus, the magnitude of stress in each cortex calculated from the film/force method was 2-3 times greater at each gait than that shown by the bone strain recordings. (29 refs.)

120904 Some mechanical properties of goose femoral cortical bone. G.B.McAlister, D.D.Moyle (Dept. of Interdisciplinary Studies, Clemson Univ., Clemson, SC, USA).
J. Biomech. (GB), vol.16, no.8, p.577-89 (1983).
The ultimate compressive strength and modulus of elasticity of femoral cortical bone from adult geese (Anser anser), were determined by sex and by quadrant by compressing small right circular cylinders which were 2.4 mm in height and 0.8 mm in diameter. The average ultimate compressive strength was 183±29 MPa. The average modulus of elasticity was 13.2±3.4 GPa. The bending strength and bending modulus of elasticity were determined by a three point bend test on rectangular prisms which had the approximate dimensions 0.75 mm×0.75 mm×25 mm. The average bending strength was 263±44 MPa while the average bending modulus was 19.6±3.1 GPa. The calcium content was determined by atomic absorption spectrophotometry and no correlation was found with the mechanical properties. The histology of the cortical bone was examined both quantitatively and qualitatively. A unique type of Haversian bone is described. (17 refs.)

120905 Fourier analysis of ground reaction forces in normals and patients with knee joint disease. E.Schneider, E.Y.Chao (Orthopedic Biomech. Lab., Mayo Clinic/Mayo Foundation, Rochester, MN, USA).
J. Biomech. (GB), vol.16, no.8, p.591-602 (1983).
Fourier analysis was performed on the ground reaction force patterns during gait in 26 normals and 10 patients with knee joint disease prior to total knee replacement. A method was developed to determine the essential number of harmonics for each force component, based on data sampling rate and the level of accuracy required in reconstructing the original patterns. The criteria used to select the level of accuracy depend upon the type of analysis to be performed. Only the first two to four harmonics, plus the constant term, were found to be the dominating coefficients in describing each of the reaction force patterns, and they are subsequently used as the key parameters in the differentiating normals and patients with knee joint disease. The advantages of this method and its implication to objective gait analysis in biomechanics are discussed. (25 refs.)

120906 The effects of composition, structure and age on the torsional properties of the human radius. D.B.Burr, R.B.Martin (West Virginia Univ. Medical Center, Morgantown, WV, USA).
J. Biomech. (GB), vol.16, no.8, p.603-8 (1983).
A standard site in the distal shaft of the radius is commonly used to monitor the skeletal status of aging individuals by photon absorptiometry. Since the adjacent metaphysis of this bone is a common site for fractures, it is important to know whether bone mineral content (BMC) is a good indicator of mechanical integrity. In concert with previous studies, the BMC of the scan site declined significantly ($p<0.005$) with age in women but in men showed no change to age 90. In spite of the loss of BMC, there was no decrease in torsional rigidity in women. In men torsional rigidity increases significantly ($p<0.05$) with age even though BMC did not change. Thus, measurements of BMC alone do not adequately reflect the mechanical integrity of a clinically significant skeletal site, and assessment of skeletal health based on such criteria may be misleading. (25 refs.)

120907 Field measurements in snow skiing injury research. C.Y.Kuo, J.K.Louie, C.D.Mote,Jr. (Dept. of Mech. Engng., Univ. of California, Berkeley, CA, USA).
J. Biomech. (GB), vol.16, no.8, p.609-24 (1983).
Field measurements during skiing experiments simultaneously recorded the complete excitation of the toe and heel of one foot, the absolute spatial orientation of the pelvis and the foot, muscle activity at the hip, knee and ankle and the complete rotation of the femur relative to the tibia across the knee in three test subjects. Data were transmitted from test subjects during the skiing experiments by a 100K bit s^{-1}. PCM-FM system and recorded in digital form. Analyses of field data show the magnitude of the loading applied to the lower extremity during normal skiing often exceeds the expected, quasistatic ultimate strength of the tibia. Anterior-posterior bending of approximately 600 Nm has been recorded during skiing without binding release or injury to the test subjects. (16 refs.)

120908 Model studies on the influence of nonstationary flow on the mean flow estimate with the indicator-dilution technique. E.A.von Reth, J.C.J.Aerts, A.A.van Steenhoven (Dept. of Mech. Engng., Eindhoven Univ. of Technol., Eindhoven, Netherlands), A.Versprille.
J. Biomech. (GB), vol.16, no.8, p.625-33 (1983).
The applicability of the indicator-dilution technique for the estimate of the mean flow under circumstances of nonstationary flow is investigated by model studies. The studies comprise experiments using a hydrodynamical model as well as calculations with a compartmental approach. The main conclusions are: (1) The influence of nonstationary flow on the mean flow estimate with the indicator-dilution technique can be described accurately by a mathematical mode based on a mixing-chamber approach. (2) The relative error in the mean flow estimate by a single measurement is dependent on the system parameters (number and time constant of mixing chambers) and the flow parameters (relative amplitude and relative frequency of flow variation and the phase with respect to the variation at the moment of injection). (3) Errors due to cyclic nonstationarities of the flow can be reduced strongly by averaging over two measurements with injection at two points of time with phases π radians apart. (13 refs.)

120909 Estimation of respiratory impedance and source pressure using a Thevenin equivalent circuit model. E.J.Cha, K.S.Park, C.W.Lee, K.Y.Yim, B.G.Min (Dept. of Biomedical Engng., Seoul Nat. Univ. Hospital, Seoul, Korea).
J. Biomech. (GB), vol.16, no.8, p.635-41 (1983).
A new technique is presented which can provide both active respiration source pressure and lung impedance in a single noninvasive test. The method is based upon a Thevenin equivalent circuit model of respiratory mechanics. Using this model, the equivalent source pressure and source impedance can be computed from the measured changes of respiratory pressures and flows in two consecutive cycles before and after addition of purely resistive loads to the mouth. In maximal breathing the source parameters were reproducible in six normal human subjects. The total respiratory resistance during maximal breathing had an average value of 3.46 cm $H_2O\ 1^{-1}\ s^{-1}$, and the total dynamic compliance had an average value of 0.0781 cm H_2O^{-1}. The airway resistances measured using a plethysmographic method were within the range of 45-65% of the estimated total respiratory resistances. These two resistances were related with a correlation coefficient of 0.98. (24 refs.)

120910 On large periodic motions of arteries. H.Demiray (Marmara Res. Inst., Kocaeli, Turkey), R.P.Vito.
J. Biomech. (GB), vol.16, no.8, p.643-8 (1983).
The large, radial periodic motion of an artery subjected to a dynamic inner pressure is studied through the use of finite deformation theory of elastic materials. The artery is assumed to behave as an isotropic, homogeneous, and incompressible elastic material. Expressions for intramural pressure and wall stresses are obtained as a function of the large periodic motion. Dynamic effects are shown to both increase the diastolic pressure and decrease the systolic pressure. It is also shown that, under certain conditions, the artery may experience a negative intramural pressure, in which case the artery may collapse. The authors predict very large circumferential stress and stress gradients which might lead the artery to arteriosclerosis. (15 refs.)

120911 Mechanics of gliding in birds with special reference to the influence of the ground effect. R.W.Blake (Dept. of Zoology, Univ. of British Columbia, Vancouver, BC, Canada).
J. Biomech. (GB), vol.16, no.8, p.649-54 (1983).
A model of the mechanics of gliding without loss of altitude (horizontal gliding) is developed. The model can be employed to assess the influence of the principal drag components (induced, profile and parasite drag), choice of initial and final glide velocities and height above the ground on glide distance. For birds gliding near to the ground the ground effect acts to decrease the induced drag and increase the lift to drag ratio of the wings. Minimum drag speed is reduced for birds gliding near to the ground. The model is applied to the gliding flight of the black skimmer (Rhyncops nigra). Glide distances for given initial and final velocities are significantly increased in the influence of the ground effect out of ground effect values. (19 refs.)

120912 The influence of aerodynamic and biomechanical factors on long jump performance. A.J.Ward-Smith (Dept. of Mech. Engng., Brunel Univ., Uxbridge, England).
J. Biomech. (GB), vol.16, no.8, p.655-8 (1983).
A new analysis, based on the equations of motion, is made of the influence of aerodynamic drag on the trajectory and aerial range achieved by a long jumper. The general result is applied to a particular case, namely the world long jump record obtained by Bob Beamon at the Mexico Olympics in 1968. Calculations are also made of the influence of body height and jumping technique on overall long-jump performance. A comparison is made between the relative importance of aerodynamic and anthropometric aspects of long jump performance. (5 refs.)

120913 The effect of impact on the marrow pressure of long bones in vitro. J.D.Bryant (Dept. of Biology, Univ. of York, Heslington, York, England).
J. Biomech. (GB), vol.16, no.8, p.659-65 (1983).
Intact fresh sheep tibiae were subjected to non-destructive impact loads while maintained in an environment like that encountered in life. Under a maximum load of 2.5 kN, and loading rate of 500 N ms^{-1}, marrow presures no higher than 50 kPa were recorded. Such low pressures would provide only a trivial amount of hydraulic strengthening, and are consistent with results from other workers carried out at lower rates of loading. (8 refs.)

120914 Finite element modelling of lungs including interlobar fissures and the heart cavity. G.C.Lee, N.T.Tseng, Y.M.Yuan (Faculty of Engng. & Appl. Sci., State Univ. of New York, Buffalo, NY, USA).
J. Biomech. (GB), vol.16, no.9, p.679-90 (1983).
Interlobar fissures and the heart cavity are incorporated into a solid lung model and their effect on the regional behavior of the lung is examined. Numerical results show that the interlobar fissures have a 'shielding' effect on the stress distribution in the upper region of the lung. The stress gradient can be reduced dramatically due to the relative movement of parenchyma along the fissure planes. Also, the heart cavity and the hilum support have the same effect of reducing the expansion ratio of parenchyma in the upper region of the lung. Therefore, the interlobar movement and the heart cavity tend to reduce the unevenness of stresses and strains in the lung as compared with the results of the solid lung model used previously by West and Matthews (1972) and used by the authors (Lee et al., 1978). (18 refs.)

120915 Correlation of myoelectric activity and muscle force during selected cat treadmill locomotion. M.H.Sherif, R.J.Gregor (Univ. of California, Los Angeles, CA, USA), L.M.Liu, R.R.Roy, C.L.Hager.
J. Biomech. (GB), vol.16, no.9, p.691-701 (1983).
The force produced by the cat medial gastrocnemius (MG) during unrestrained treadmill locomotion was associated with the corresponding myoelectric signals (MESs). An intervention analysis based on an autoregressive-integrated moving average process was performed on records obtained at treadmill speeds of 0.67 m s^{-1} and 2.24 m s^{-1}. Results indicate that the pattern of MG myoelectric activity during a single step cycle may be divided into two parts. The primary burst (E_1 burst) of activity occurs before foot contact and represents an energy build up which is related to a major part of the MG force monitored at the tendon. During stance, a second burst of activity is depicted by an almost critically damped second order system, and is responsible for the residual tension observed. Thus in vivo forces can be linked to MESs provided that phase differences between electrical and mechanical responses are taken into account. (34 refs.)

120916 Analysis of the passive mechanical properties of rat carotid arteries. H.W.Weizsacker, H.Lambert, K.Pascale (Physiologisches Inst., Karl Franzens Univ., Graz, Austria).
J. Biomech. (GB), vol.16, no.9, p.703-15 (1983).
The passive mechanical properties of rat carotid arteries were studied in vitro. Using a tensile testing machine and a piston pump, intact segments of carotid arteries were subjected to large deformations both in the longitudinal and circumferential directions. Internal pressure, external diameter, length, and longitudinal force were measured during the experiment and compared with the in vivo dimensions of the segments prior to excision. The anisotropic mechanical properties of the vessel wall material were analyzed using incremental elastic moduli and incremental Poisson's ratio. The results suggest that there is a characteristic deformation pattern common to all vessels investigated which is highly correlated with the conditions of loading that occur in vivo. That is, under average physiological deformation of the vessel, the longitudinal force is nearly independent of internal pressure. In this range of loading the circumferential incremental elastic modulus is nearly independent of longitudinal strain. However, the longitudinal and radial incremental elastic moduli vary significantly with deformation in this direction. The values of the moduli in all three directions increase with raising internal pressure. The weak coupling between circumferential and longitudinal direction in the wall material of carotid arteries is shown by the small value of the corresponding incremental Poisson's ratios. (29 refs.)

120917 Quantitative gait evaluation of hip diseases using principal component analysis. S.Yamamoto, Y.Suto, H.Kawamura, T.Hashizume, S.Kakurai (Tokyo Metropolitan Prosthetic & Orthotic Res. Inst., Tokyo, Japan), S.Sugahara.
J. Biomech. (GB), vol.16, no.9, p.717-26 (1983).
The measurement of five gait parameters, namely, joint angular displacement of flower extremities, floor reaction forces, trajectory for a point of force application, temporal factor and distance factor has been performed with ease and high speed using mini-computer on-line real-time processing. Gait data of 211 patients with hip diseases was normalized, quantified and summarized by the principal component analysis. A 'gait evaluation plane' was formed according to the results obtained by the principal component analysis. The gait evaluation using the plane was compared with clinical conditions of patients, and it was evident that this system can evaluate the recovery of the gait by treatment. (14 refs.)

120918 Finite-element-analysis and experimental investigation in a femur with hip endoprosthesis. A.Rohlmann, U.Mossner, G.Bergmann (Dept. of Orthopaedic Surgery, Free Univ. Berlin, Berlin, Germany).
J. Biomech. (GB), vol.16, no.9, p.727-42 (1983).
The stress distribution in a human femur with an endoprosthesis was determined. The finite element method (FEM) was used for a three-dimensional model with more than 15000 degrees of freedom. Geometrical and material data had been taken for this model from a left femur with endoprosthesis. On the contralateral bone a strain gauge investigation was performed to validate the calculations. Reasonable agreement was achieved. Various modes of loading were investigated. A perfect bond at the interface between materials of different elastic moduli was assumed. The results are valid for endoprosthesis with such structured stem surfaces as allow transfer of tensile and shear stresses. (27 refs.)

120919 Multiaxial strength characteristics of trabecular bone. J.L.Stone, G.S.Beaupre, W.C.Hayes (Charles A. Dana Res. Inst., Beth Israel Hospital, Boston, MA, USA).
J. Biomech. (GB), vol.16, no.9, p.743-52 (1983).
Bovine trabecular bone specimens were tested in multiaxial stress, including pure shear, in a special test device. Shear strength was proportional to apparent density to the exponent 1.65, in approximate agreement with theoretical and experimental studies on the shear strengths of porous foams. The mean shear strength was 6.60±1.66 MPa, after normalizing for apparent density. This compares well with normalized shear strengths from Saha and Gorman's (1981) study on human femora. A scanning electron microscope study indicated random trabecular architecture and a complex fracture mechanism at the level of the individual trabecular struts. Hoffmann's (1967) 3-D isotropic failure criterion was applied to the multiaxial test data, along with data from uniaxial compression tests, indicating a compressive strength approximately three times the tensile strength. (34 refs.)

120920 Comparison of steady and pulsatile flow in a double branching arterial model. R.J.Lutz, L.Hsu, A.Menawat, J.Zrubek, K.Edwards (Div. of Res. Services, Nat. Inst. of Health, Bethesda, MD, USA).
J. Biomech. (GB), vol.16, no.9, p.753-66 (1983).
Data are presented to compare fluid flow parameters for steady flow with those for time-varying flow in a simplified two branch model which simulates the region of the abdominal aorta near the celiac and superior mesenteric branches of the dog. Measurements in the model included laser doppler anemometry velocity profiles during steady flow, sinusoidal flow with a superimposed mean flow (referred to as simple oscillatory flow) and arterial pulsatile flow. Shear rate measurements were made by an electrochemical technique during steady flow. Flow visualization studies were done during steady and pulsatile flow. Fluid flow effects in the simplified model during steady flow showed many similarities to the results from previous steady flow studies in a canine aortic cast (Lutz et al., 1977). Shear rates in the region of the proximal (first, or celiac) branch were independent of flow rates in the distal (second, or mesenteric) branch, but the shear pattern within the proximal branch changed significantly as flow in the proximal branch increased. Shear rates on the proximal flow divider (leading edge into the distal branch) depended primarily on the flow rate to the proximal branch, but not on flow to the distal branch. At certain daughter branch flow ratios (approximately 2:1, proximal to distal), flow separation was promoted at the outer wall of the second branch, but flow separation did not occur in the first branch. (33 refs.)

120921 Comparative evaluation of techniques for the harmonic analysis of human motion data. A.Cappozzo, F.Gazzani (Lab. of Biomech., Univ. degli Studi 'La Sapienza', Roma, Italy).
J. Biomech. (GB), vol.16, no.9, p.767-76 (1983).
Four mathematical techniques for the estimation of the Fourier coefficients of pseudoperiodic nonexact discrete functions were submitted to comparative evaluation. These techniques were devised within the following basic procedures: (1) numerical harmonic analysis applied either directly or after redistribution of the data points through some interpolation procedure, so that they be evenly spaced in time and exactly fit one cycle period; (2) fitting of the empirical data with an analytical model followed by the calculation of the Fourier integrals of this model. The evaluation was carried out with special reference to the use of these techniques for processing human motion photogrammetric data. The following criteria were used: (1) accuracy of the Fourier coefficient estimates, (2) capability of yielding information about this accuracy, (3) a priori information needed regarding the statistical properties of the experimental error, (4) factors concerning implementation in digital computers. Practical information was obtained for the nonspecialist user with regard to the choice of one technique among the several possible in particular cirumstances. (14 refs.)

120922 Response of a two-dimensional dynamic model of the human knee to the externally applied forces and moments. M.H.Moeinzadeh (Dept. of General Engng., Univ. of Illinois, Urbana-Champaign, IL, USA), A.E.Engin.
J. Biomed. Eng. (GB), vol.5, no.4, p.281-91 (Oct. 1983).
Deals with the response of a two-dimensional dynamic model of the human knee to the externally applied forces and moments. The profiles of the articulating surfaces of a normal knee joint are determined from X-ray films and they are represented by polynomials. Ligaments of the joint are modelled as nonlinear elastic springs of realistic stiffness properties. Nonlinear equations of motion, coupled with nonlinear constraint conditions, are solved numerically. Time derivatives are approximated by Newmark difference formula and the resulting nonlinear algebraic equations are solved employing the Newton-Raphson iteration scheme. Several dynamic loads (force and moment) are applied to the tibia and subsequent motion is investigated. Results for the ligament and contact forces, contact point locations between femur and tibia and the corresponding dynamic orientation of tibia with respect to femur are presented. (36 refs.)

120923 Effect of myocardial fibre architecture on the behaviour of the human left ventricle in diastole. A.L.Yettram (Dept. of Mech. Engng., Brunel Univ., Uxbridge, England), C.A.Vinson, D.G.Gibson.
J. Biomed. Eng. (GB), vol.5, no.4, p.321-8 (Oct. 1983).
Stress and deformation results from finite element analyses are presented for a series of models of the human left ventricle. The myocardium has a complex anisotropic fibre structure, an idealized version of which has been developed. Variations are made on both fibre orientation and on the ratio of the elastic moduli along and across the fibres. The results show that, at least in diastole, when the left ventricle is considered as a passive structure under the action of the internal blood pressure, the effect of the real fibre arrangement is generally to reduce deformation and also the direct stresses. In spite of fibre angle changing across the wall, the analysis correctly predict the lack of rotation of the left ventricle about the long axis. (17 refs.)

120924 Etiology and biomechanics of hernial sac formation. A.E.Engin (Dept. of Engng. Mech., Ohio State Univ., Columbus, OH, USA), N.Akkas.
J. Biomed. Eng. (GB), vol.5, no.4, p.329-35 (Oct. 1983).
This paper, to the authors' best knowledge, presents the first attempt on the understanding of the biomechanics of hernial sac formations. First, a brief survey of the selected etiological factors and their related theories on hernia is given. Next, the results of some preliminary tensile tests conducted on normal and sac peritoneum are discussed. The third part of the paper is concerned with a theoretical model which incorporates both material and geometric nonlinearities by considering deformation of circular membrane under internal fluid pressure. The influence of the material properties of the peritoneal sac, its thickness and its initial radius of curvature, as well as the internal fluid pressure on the growth of the sac are illustrated. The existence of a critical value for a non-dimensional parameter is shown and it is proposed that the herniation process can be viewed as a biomechanically unstable phenomenon in the light of the present model. (43 refs.)

120925 Evaluation of the mechanical behavior of compact deproteinized and demineralized bone tissue under tension. M.A.Dobelis, A.E.Melnis (Inst. of Polymer Mech., Acad. of Sci., Riga, Latvian SSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.719-25 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.1060-6 (Nov.-Dec. 1982). [received: Sept. 1983]
The data obtained indicates that the method used for bone deproteinization permits investigation of the mineral bone component with retained structure of the hydroxyapatite crystals. The continuous mineral component is a composite, spatially organized structure with amorphous and crystalline segments. The rather high rigidity of this component indicates that the elastic properties of bone tissue are largely a factor of the mineral component. The strength and specific deformation energy of the mineral bone component are significantly enhanced due to effective distribution and transmission of microstresses by the organic component in the bone biocomposite itself. (16 refs.)

120926 Biomechanical aspects of the fracture resistance of the human spine upon the action of head-pelvis impact overloads. G.P.Stupakov, V.A.Elivanov, A.P.Kozlovskii, V.S.Kazeikin, V.V.Korolev.
Mech. Compos. Mater. (USA), vol.18, no.6, p.726-30 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.1067-71 (Nov.-Dec. 1982). [received: Sept. 1983]
Experiments were carried out on segments of the human spine including two lower thoracic and three upper lumbar vertebrae (T_{XI}-L_{III}) as well as on human corpses. The segments were removed from the corpses of males (biological models) who died suddenly at ages from 20 to 50 years from causes not affecting the state of the skeletal system. The segments were subjected to impact on a pile-driver apparatus with a dropping platform after their prior stressing by a rigid structure (upper mass) corresponding to the mass of the lower body. (2 refs.)

120927 Elastic properties of the human aortic wall relative to aging. N.M.Fruntash (Kishinev State Medical Inst., Kishinev, USSR).
Mech. Compos. Mater. (USA), vol.18, no.6, p.730-4 (Nov.-Dec. 1983). Translation of: *Mekh. Kompozitnykh Mater. (USSR)*, vol.18, no.6, p.1072-6 (Nov.-Dec. 1982). [received: Sept. 1983]
The ultimate strength, rupture extension, and elasticity coefficient of the human aortic wall during postnatal ontogeny was investigated. The aorta was taken 8-14 h after death in individuals without cardiovascular pathology. The visually least altered segments of the aortic wall were taken for study from aged individuals. General atherosclerosis or the sclerosis of individual groups of vessels was indicated as an incidental diagnosis. (22 refs.)

120928 Effect of timing and velocity of impact on ventricular myocardial rupture. I.V.Lau (Biomedical Sci. Dept., General Motors Res. Labs., Warren, MI, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.1-5 (Feb. 1983). [received: Oct. 1983]
The effects of impact timing during the cardiac cycle on the sensitivity of the heart to impact-induced rupture was investigated in an open-chest animal model. Direct mechanical impacts were applied to two adjacent sites on the exposed left ventricular surface at the end of systole or diastole. Impacts at 5 m/s and a contact stroke of 5 cm at the end of systole resulted in no cardiac rupture in seven animals, whereas similar impacts at the end of diastole resulted in six cardiac ruptures. Direct impact at 15 m/s and a contact stroke of 2 cm at the end of either systole or diastole resulted in perforationlike cardiac rupture in all attempts. At low-impact velocity the heart was observed in high-speed movie to bounce away from the impact interface during a systolic impact, but deform around the impactor during a diastolic impact. The heart generally remained motionless during the downward impact stroke at high-impact velocity in either a systolic or diastolic impact. The lower ventricular pressure, reduced muscle stiffness, thinner myocardial wall and larger mass of the filled ventricle probably contributed to a greater sensitivity of the heart to rupture in diastole at low-impact velocity. However, the same factors had no role at high-impact velocity. (12 refs.)

120929 Filling of partially collapsed compliant tubes. D.L.Jan, R.D.Kamm, A.H.Shapiro (Dept. of Mech. Engng., MIT, Cambridge, MA, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.12-19 (Feb. 1983). [received: Oct. 1983]
Filling of a thin-walled, highly compliant tube in a partially collapsed condition is studied. The theory, based on one-dimensional flow, takes account of friction, longitudinal tension, and the highly nonlinear pressure-area law for the tube. Various aspects of filling behaviour are revealed by alternative calculations using: (i) the method of characteristics; (ii) numerical integration of the continuity, momentum, and tube-law equations; and (iii) a crude but simple lumped-element capacitance-inertance-resistance model. Varied phenomena appear. At high Reynolds number, these include dispersive wave trains associated with circumferential bending stiffness and longitudinal tension, nonlinear changes of waveform, development of highly asymmetrical wave reflections, and sloshing. At low Reynolds number, the area changes with time in a diffusivelike manner. The experiments exhibited the dispersive phenomena predicted by the theory. (17 refs.)

120930 Static analysis of the left ventricle. A.Tozeren (Dept. of Engng. Sci., Orta Dogu Teknik Univ., Ankara, Turkey).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.39-46 (Feb. 1983). [received: Oct. 1983]
Static analysis of the left ventricle is developed to estimate the local stresses and deformations that occur during the heart cycle. The left ventricle is represented as a thick hollow tube composed of solid fibers embedded in an inviscid fluid matrix. A finite deformation analysis is developed to estimate the variation of the pressure, fiber tension and fiber extension across the thickness of the left ventricle. Pressure-volume relations are obtained for the diastolic and the systolic peak isovolumetric phases. The fiber stress distribution and pressure variation are estimated as a function of the initial fiber orientation distribution, relative thickness of the ventricle, inner volume of the ventricle and the various tension-extension relations proposed for the fibers of the heart muscle. It is concluded that the diastolic pressure-volume relation is not very sensitive to either the fiber orientation distribution or the thickness of the ventricle. However, the pumping efficiency of the modeled ventricle is shown to increase with increasing thickness of the modeled left ventricle and with increasing contractility of the heart muscle fibers. (24 refs.)

120931 Rhesus monkey intervertebral disk viscoelastic response to shear stress. B.S.Kelley, J.F.Lafferty, D.A.Bowman, P.A.Clark (Wenner-Gren Aeronautical Res. Lab., Univ. of Kentucky, Lexington, KY, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.51-4 (Feb. 1983). [received: Oct. 1983]
A viscoelastic model of the shear response of the Rhesus monkey intervertebral disk, represented by a series chain of four Kelvin units is presented. Two types of investigations are carried out to assess the validity of the model: (1) determination of material properties by comparison with experimental strain creep behaviour of the disk; and (2) validation of this viscoelastic model by accurately predicting the experimental results of stress relaxation tests. The use of the series Kelvin units approach provides the first analytical mechanical model capable of predicting the creep and relaxation functions for the intervertebral disk in shear. (11 refs.)

120932 Joint models, degrees of freedom, and anatomical motion measurement. G.L.Kinzel, L.J.Gutkowski (Dept. of Mech. Engng., Ohio State Univ., Columbus, OH, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.55-62 (Feb. 1983). [received: Oct. 1983]
When the motion associated with an anatomical joint is to be measured, a kinematic model for the joint must first be established. The joint model will have from one to six degrees of freedom, and both the measurement technique and the means used to describe the motion will be influenced by the model and its degrees of freedom. This paper discusses the modeling and measurement of anatomical joint motion from a kinematics viewpoint. A review of the literature pertaining to measurement techniques, kinematic assumptions, and motion descriptions for anatomical joint motion is presented. One, two, three and six degree of freedom models for various anatomical joints have appeared in the literature, and the applicability of these models is compared and discussed. (69 refs.)

120933 Response of an advanced head-neck model to transient loading. J.M.Winters, W.Goldsmith (Dept. of Mech. Engng., Univ. of California, Berkeley, CA, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.63-70 (Feb. 1983). [received: Oct. 1983]
A second-generation mechanical head-neck model was constructed, instrumented and subjected to pendulum impact tests against both the head and torso and directed from the front, rear and side. The response history of the system was measured by thirty channels of instrumentation including disk pressure transducers and muscle displacement gages in the neck, and a central accelerometer, intracranial pressure transducers and skull strain gages for the cranium and its contents. The kinematics of the unit was observed by an intermediate speed framing camera and the input was determined by a calibrated force transducer located at the contact point. It was found that peak head linear acceleration and velocity occur either during or immediately after the impact, with corresponding peak rotational values manifested somewhat later, but well before maximum head displacement. Head accelerations were similar, albeit slightly lower than in corresponding cases for an earlier model and displacement values were also similar until large extensions were reached. For rear head or frontal base impact, the head experienced a significant period of translation without rotation immediately after loading, and the system appears to respond more violently to side than to corresponding front or rear impact. (28 refs.)

120934 Mechanical behavior of fetal dura mater under large axisymmetric inflation. T.J.Kriewall (Orthopaedic Products Div., 3M Co., St. Paul, MN, USA), N.Akkas, D.I.Bylski, J.W.Melvin, B.A.Work,Jr..
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.71-6 (Feb. 1983). [received: Oct. 1983]
The nonlinear mechanical behavior of fetal dura mater was tested experimentally and compared to two published nonlinear material strain energy functions, the Mooney-Rivlin and the Skalak, Tozeren, Zarda, and Chien (STZC). The STZC constitutive relations best fit the behavior of the dura mater and were used to describe quantitatively its stiffness. Runge-Kutta numerical procedures were used to fit the theoretical data to the experimental results. The material's stiffness was positively correlated with fetal weight ($r=0.67$, $p<0.05$). These results are discussed and directions for future research indicated. (20 refs.)

120935 Acoustic modeling of lung dynamics using Bond graphs. D.L.Margolis, M.Tabrizi (Univ. of California, Davis, CA, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.84-91 (Feb. 1983). [received: Oct. 1983]
Bond graphs are used to model the acoustic behavior of the respiratory system. The model includes the distributed dynamics of the upper airways while the lower passage generations are represented by 'lumping' of resistance and compliance effects. The lower airway representation is terminated with ten lung segments. The model is accurate for frequencies as high as 8500 Hz. The model is currently capable of predicting system eigenvalues as a function of system parameters and geometry for a 'nonbreathing' lung. Future plans include modifying the model to include lung segment expansion and contraction as well as turbulence generation at airway bifurcations. (13 refs.)

120936 A concise sensitivity analysis of the quasi-linear viscoelastic model proposed by Fung. A.A.H.J.Sauren, E.P.M.Rousseau.
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.92-5 (Feb. 1983). [received: Oct. 1983]
Y.C.B. Fung (see Biomechanics: its foundations and objectives, ch.7, p.181-208, 1972) has proposed a quasi-linear viscoelastic theory which gives a constitutive equation relating stress and strain for a soft biological tissue. In order to account for the remarkable strain rate insensitivity of both the stress-strain relation and the hysteresis loop of many soft biological issues, Fung proposed a specific relaxation spectrum of the form $S(\tau)=C/\tau$ for $0<\tau_1\leq\tau\leq\tau_2$, and $S(\tau)=0$ elsewhere, where C represents a dimensionless positive constant and τ_1 and τ_2 are time constants. The authors analysis indicates that the parameter C is the most important as it determines the degree to which viscous effects are present. The time constants τ_1 and τ_2 govern respectively, the 'fast' and 'slow' viscous phenomena. (9 refs.)

120937 Impulse and moment of impulse in the leg joints by impact from kicking. L.Lindbeck (Dept. of Mech., Royal Inst. Technol., Stockholm, Sweden).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.108-11 (May 1983). [received: Oct. 1983]
In a previous paper (see Scand. J. Rehab. Med., vol.10, p.93-106, 1978) the authors gave a theoretical analysis of the impulsive motion of the leg, modeled as a double pendulum. This analysis made it possible to estimate the

impulsive reactions in the knee joint as a function of the measured initial and final velocities of the leg, when an impact was given to the lower leg, e.g. by means of a kick. This estimation was made under the assumption that no impulsive moments occur in the hip and the knee joints, i.e. that no muscles were stretched during the time of impact. In the present paper it is shown how such impulsive moments, should they occur, can be determined by means of an additional measurement, i.e. of the velocity of the ball after the impact. The results from a series of experiments are reported, showing that such impulsive moments in the joints occur in an appreciable number of the kicks, especially in the hip joint, indicating that muscles, acting on this joint, are prestressed during the impact. (3 refs.)

120938 Pulsatile flow in tapered tubes: a model of blood flow with large disturbances. E.Kimmel, U.Dinnar (Dept. of Biomedical Engng., Technion-Israel Inst. of Tech., Haifa, Israel).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.112-19 (May 1983). [received: Oct. 1983]
Blood flow-through segments of large arteries of man, between adjacent bifurcations, can be modeled as pulsatile flow in tapered converging tubes, of small angle of convergence, up to 2 deg. Assuming linearity, rigid tube and homogeneous Newtonian fluid, the physiological flow field is governed by the Navier-Stokes equation with dominant nonlinear and unsteady terms. Analytical solution of this problem is presented based on an integral method technique. The solution shows that even for small tapering the flow pattern is markedly different from the flow obtained for a uniform tube. The periodic shear stresses at the wall and pressure gradients increase both in their mean value and amplitude with increased distance downstream. These results are highly significant in the process of atherogenesis. (22 refs.)

120939 A joint coordinate system for the clinical description of three-dimensional motions: application to the knee. E.S.Grood, W.J.Suntay (Dept. of Orthopaedic Surgery, Univ. of Cincinnati Medical Center, Cincinnati, OH, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.136-44 (May 1983). [received: Oct. 1983]
The experimental study of joint kinematics in three dimensions requires the description and measurement of six motion components. An important aspect of any method of description is the ease with which it is communicated to those who use the data. This paper presents a joint coordinate system that provides a simple geometric description of the three-dimensional rotational and translational motion between two rigid bodies. The coordinate system is applied to the knee and related to the commonly used clinical terms for knee joint motion. A convenient characteristic of the coordinate system shared by spatial linkages is that large joint displacements are independent of the order in which the component translations and rotations occur. (29 refs.)

120940 An analytical technique for modeling knee joint stiffness. II. Ligamentous geometric nonlinearities. M.S.Hefzy, E.S.Grood (Dept. of Orthopaedic Surgery, Univ. of Cincinnati Medical Center, Cincinnati, OH, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.145-53 (May 1983). [received: Oct. 1983]
For pt.I see ibid., vol.104, p.330-7, 1982. The analytical technique previously developed in pt.I to evaluate the contribution of the ligaments to the nonlinear, coupled stiffness characteristics of the human knee joint is extended here to include geometric nonlinearities. In pt.I the authors assumed that the ligaments act as tensile bands running in a straight line between tibial and femoral insertion sites. Here, two forms of geometric nonlinearities are introduced and analyzed: ligaments wrapping around bone surfaces, such as occurs with the medical collateral ligament, the posterior capsule, and the anterior cruciate in hyperextension, and wrapping of ligaments around each other, such as occurs, with the cruciate ligaments as the knee is flexed and internally rotated. (16 refs.)

120941 Tension-torsion charcteristics of the canine anterior cruciate ligament. I. Theoretical framework. D.C.Stouffer (Univ. of Cincinnati, Cincinnati, OH, USA), D.L.Butler, H.Kim.
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.154-9 (May 1983). [received: Oct. 1983]
It has been observed that the fascicles in the canine anterior cruciate ligament do not follow a straight line path between the tibial and femoral attachment sites, but rather their path is approximately helical about the ligament axis. Thus, a mathematical model for the mechanical response of a ligament was developed from the observed geometrical configuration of the fascicle. The principal result of the model indicated that a torque must always accompany the force during elongation of a ligament. The relationships between the ligament and fascicle variables are also examined in detail. (38 refs.)

120942 Tension-torsion characteristics of the canine anterior cruciate ligament. II. Experimental observations. D.L.Butler, D.C.Stouffer (Univ. of Cincinnati, Cincinnati, OH, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.160-5 (May 1983). [received: Oct. 1983]
For pt.I see ibid., vol.105, no.2, p.154-9, 1983. An experimental program was devised to determine whether the canine anterior cruciate ligament (ACL), with an apparent helical twist of its component fiber bundles, could support a torque during axial loading to failure. At the point of first significant failure, the anterior cruciate was found to develop an average maximum torque of 122 ± 26 N-mm ($\bar{X} \pm$SEM) for the nine tension-torsion tests performed. A nearly linear axial force-torque curve was also observed where the average slope of all tests was 5.2 ± 0.2 mm^{-1} ($\bar{X} \pm$SEM). The experimental axial force data was then used to determine material parameters in the constitutive equation for the fascicle and underlying bone. A nonlinear ligament model based on this response was found to reproduce the axial force data adequately and to reasonably predict the observed ligament torque over the entire subfailure loading range. (26 refs.)

120943 Cycle-dependent and time-dependent bone fracture with repeated loading. D.R.Carter, W.E.Caler (Mech. Engng. Dept., Stanford Univ., Stanford, CA, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.166-70 (May 1983). [received: Oct. 1983]
Fatigue tests of human cortical bone (up to 1.74×10^6 cycles) were conducted under tension-compression (T-C) and zero-tension (O-T) modes with a 2 Hz, stress controlled, sinusoidal loading history. Tensile creep-fracture tests at constant stress levels were also performed. The relationship between the initial cyclic strain range and cycles to failure with the T-C specimens were consistent with that derived previously in low-cycle fatigue under strain control. Using a time-dependent failure model, the creep-fracture data was found to be consistent with previous studies of the influence of strain rate on the monotonic tensile strength of bone. The model also predicted quite well the time to failure for the O-T fatigue specimens, suggesting that creep damage plays an important role in O-T fatigue specimens. (24 refs.)

120944 Pre-collapse stress redistributions in femoral head osteonecrosis—a three-dimensional finite element analysis. T.D.Brown, G.L.Hild (Dept. of Orthopaedic Surgery & Civil Engng., Univ. of Pittsburgh, Pittsburgh, PA, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.171-6 (May 1983). [received: Oct. 1983]
Three-dimensional finite element analysis was used to explore the influence of several lesion characteristics upon mechanical stress distributions in segmentally necrotic human femoral heads. Variables studied parametrically included apparent modulus deficits within the lesion proper, as well as the depth, width, and location of the infarcted head regions. The detailed patterns of stress redistribution were complex and were found to be a strong function of the specific lesion characteristics. The salient phenomenon, however, was one of preferential load uptake by the stiffer bone surrounding the lesion. Since computed stress reductions within the infarctions were usually much smaller than experimentally observed strength reductions, the data suggest a strong tendency for an elevated incidence of trabecular fatigue fractures in the affected regions. (23 refs.)

120945 Measurement of turbulence intensity in the center of the canine ascending aorta with a hot-film anomometer. T.Yamaguchi, S.Kikkawa (Dept. of Surgical Sci., Heart Inst. Japan, Tokyo Women's Medical Coll., Tokyo, Japan), T.Yoshikawa, K.Tanishita, M.Sugawara.
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.177-87 (May 1983). [received: Oct. 1983]
The blood flow velocity near the central axis of the canine ascending aorta was measured with a hot-film anemometer. The cordiac output and the heart rate were controlled at will by means of an extracorporeal circulation and by atrial pacing. The turbulent component of the blood flow velocity was calculated using an ensemble average technique. Ensemble average turbulent intensity was also calculated to show the time course of turbulence in the aorta. The ratio of the mean turbulence intensity to the time mean sectional average velocity in the aorta was constant in most animals regardless of the changes in fluid mechanical parameters. The correlation between the frequency parameter and the relative mean turbulence intensity was weakly positive. The power spectrum of the turbulence was also calculated. (32 refs.)

120946 Poisson's ratio and incompressibility. D.L.Vawter (Dept. of Engng. Sci. & Mech., Georgia Inst. of Technol., Atlanta, GA, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.194-5 (May 1983). [received: Oct. 1983]
It is well known that many biological materials are incompressible or at least nearly incompressible. In many earlier analyses incompressibility has been mathematically modeled by prescribing Poisson's ratio to be 0.5. This procedure works only when either the strains are infinitesimal or the stress in the three principal directions are equal. The volume expansion of a material, of course, is a function only of the deformation of the material. The fact that it is simple related to material constants (i.e. Poisson's ratio) for very small strians must be considered fortuitous and cannot be expected in the general case. In this note the authors show that for finite deformation, even if the stress-strain relationship is linear and isotropic, the condition of incompressibility cannot be simply modeled by setting the value of a particular material constant to a predetermined value. Although the authors present results for a linear stress-strain relationship, it is also shown that the foregoing approach cannot work for incrementally linear stress-strain relationships. (no refs.)

5th International Congress of Biorheology .... See Entry 116912

10th Annual Conference of the Association for Aerosol Research (Gesellschaft fur Aerosolforschung) .... See Entry 116920

Heat and water vapor transport in the human upper airways at hyperbaric conditions .... See Entry 120814

Human factors and behavioral science: central control of movement timing .... See Entry 120825

Change in the mechanical parameters as a possible mode of information processing by the neurone .... See Entry 120826

The effects of contact lens deformation on tear film pressure and thickness during motion of the lens towards the eye .... See Entry 120840

Laser speckle technique for the visualization of retinal blood flow .... See Entry 120849

Cranial and phrenic nerve responses to changes in systemic blood pressure .... See Entry 120869

Effect of irradiation on the microviscosity of the nuclear membrane of tumour and liver cells of tumour bearing animals .... See Entry 120964

Noninvasive method for detecting laryngeal narrowing with low-frequency sound .... See Entry 120968

Eye deformation measurement by laser interferometry .... See Entry 120977

Non-invasive microwave monitoring of respiratory pattern .... See Entry 120979

Nuclear magnetic resonance blood flow measurements in the human brain .... See Entry 120981

A microscope-television system for online measurement of blood flow velocity in microvessel using an adaptive window .... See Entry 120983

Radionuclide studies on ventilation and perfusion in different lung regions .... See Entry 120987

A computerized mass spectrometer and flowmeter system for respiratory gas measurements .... See Entry 121029

Steady-state analysis and evaluation of a new thermal sensor for surface measurements of tissue perfusion .... See Entry 121030

Which parameters of circulation can be made visible by electronic oscillography? III .... See Entry 121032

Detection of muscle tremors and baseline sway in an ECG .... See Entry 121034

Noninvasive measurement of pleural pressure by surface inductive plethysmography .... See Entry 121036

Noninvasive ventilatory monitoring with bellows pneumographs in supine subjects .... See Entry 121037

Ergometric evaluation of pathological gait .... See Entry 121038

Using body surface movements to study breathing .... See Entry 121040

A gait analysis system in clinical practice .... See Entry 121042

A programmable limb testing system (and some measurements of intrinsic muscular and reflex-mediated stiffnesses) .... See Entry 121044

Error analysis of a system for measuring three-dimensional joint motion .... See Entry 121045

Monitoring fracture site properties with external fixation .... See Entry 121054

Design of a pulse duplicator system for prosthetic heart valves .... See Entry 121056

High-speed cineradiographic system for biomechanics impact research .... See Entry 121062

Measurement of displacements introduced by extra-oral orthodontic forces on a macerated skull by means of speckle interferometry: a preliminary report .... See Entry 121065

A constant-velocity cycle ergometer for the study of dynamic muscle function . ... See Entry 121066

Two-sidearm tracheal cannula for respiratory airflow measurements in small animals .... See Entry 121067

A respiratory function jacket for measuring tidal volume and changes in FRC .... See Entry 121068

A programmable electrically braked ergometer .... See Entry 121069

A Hall effect transducer for measuring length changes in mammalian diaphragm .... See Entry 121070

A close-range photogrammetric system for 3-D measurements and perspective diagramming in biomechanics .... See Entry 121072

Mechanical characterization of membranelike biological tissue .... See Entry 121084

Determination of the local erosion stress of the canine endothelium using a jet impingement method .... See Entry 121085

87.50 BIOLOGICAL EFFECTS OF RADIATIONS

(inc. effects of fields)

120947 The RBE of the leakage radiation from the Hiletron neutron therapy unit. F.Chen, J.H.Hendry, G.Chu, D.Greene (Regional Dept. of Phys. & Bioengng., Christie Hospital & Holt Radium Inst., Manchester, England), M.Bianchi.
Br. J. Radiol. (GB), vol.56, no.668, p.551-8 (Aug. 1983).
The RBE of the leakage radiation from the Hiletron 14.7 MeV neutron therapy unit has been measured using three sensitive biological systems in mice, which differ markedly in their radiobiological characteristics. These systems comprise type A spermatogonia and bone marrow stem cells, which are affected insignificantly by dose rate, and pigment abnormalities in hair follicles which are affected markedly by dose rate. For mice irradiated at 10 cm depth in a water phantom, the leakage radiation up to 40 cm from the beam axis was virtually as effective as the primary beam for the latter two biological systems, and for spermatogonia in mice when irradiated in air. At this distance, the total dose rate was about 0.2 cGy (rad) per minute (3% of that in the primary beam), and the γ-ray component was about 70%. This equal effectiveness of the total dose for all three systems was considered fortuitous, and it implied high RBE values for equal effect with the small neutron component at far distances. Considering published data on RBE versus neutron energy, the evidence suggested either a positive interaction of neutron and γ-ray components in killing bone marrow stem cells when the neutron component was less than 40% of the total dose, or an increased efficiency of neutrons when delivered at very low dose rates. However the components were additive in killing spermatogonia. (24 refs.)

87.50B Interactions of biosystems with radiations

120948 Role of the physical characteristics of laser radiation in light absorption by haeme-containing biological membranes. V.A.Dubrovskii, V.V.Gusev, O.G.Astaf'eva (Saratov State Medical Inst., Saratov, USSR).
Biophysics (GB), vol.27, no.5, p.953-5 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.5, p.908-9 (1982). [received: Sept. 1983]
Laser radiation is characterized by a high degree of spatial and temporal coherence, spectral density of radiation and polarizability for some types of optical quantum generators. The aim of this work was to identify the influence of these factors on the primary act of the photochemical effect—light absorption. For this purpose the authors made an experimental comparison of light absorption by the haemolysate, oxyhaemoglobin and the enzyme catalase on irradiation with sources of red light with different physical properties. (4 refs.)

120949 Biological aspects of light distribution in scattering media. M.Seyfried, E.Schafer, L.Fukshansky (Univ. Freiburg, Freiburg, Germany).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.574-80 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Two models are presented for light propagation in absorbing and scattering media, which are both based on the Kubelka-Munk theory. The models allow, within the general restrictions of the approach, the evaluation of light flux gradients across layered objects with specular reflection at the object boundaries; and the evaluation of optical pathlengths and pathlength distributions for the transmitted, reflected or absorbed light. (9 refs.)

120950 Soft tissue attenuation of acoustic emission pulses. T.M.Wright, J.M.Carr (Dept. of Biomech., Hospital for Special Surgery, New York, NY, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.20-23 (Feb. 1983). [received: Oct. 1983]
The soft tissue attenuation of acoustic emission signals was measured by transmitting pulses through volunteers and measuring the decay of the waveform characteristics of the pulse as a function of the thickness of the interposed tissue. Waveform characteristics of the received signal (signal duration, number of counts, peak amplitude, energy, and rise time) demonstrated an exponential decrease with increasing tissue thickness. The decrease appeared insensitive to the frequency of the pulse within the range of 50 to 600 kHz. (12 refs.)

120951 Changes in myocardial backscatter throughout the cardiac cycle. E.I.Madaras, B.Barzilai, J.E.Perez, B.E.Sobel, J.G.Miller (Dept. of Phys., Washington Univ., St. Louis, MO, USA).
Ultrason. Imaging (USA), vol.5, no.3, p.229-39 (July 1983).
This investigation was performed to identify and quantify systematic variations of myocardial ultrasonic backscatter throughout the cardiac cycle. Using a broadband 5 MHz focused transducer coupled to the epicardial surface of the left ventricle in dogs, backscatter measurements were obtained from each of 7 intervals (windows) of 34 milliseconds duration evenly distributed throughout the cardiac cycle and referenced to backscatter from a steel reflector. Values of integrated backscatter obtained demonstrated a consistent and reproducible pattern throughout the cardiac cycle characterized by elevated values at end-diastole and significantly lower values at end-systole. The average maximum difference was 3.5 dB. (25 refs.)

120952 Ultrasound velocity in fixed human liver: empirical anova and regression modelling on histologically assessed abnormalities. K.P.Zimmermann (Dept. of Electrical Engng., Univ. of Missouri, Columbia, MO, USA), J.C.Smith.
Ultrason. Imaging (USA), vol.5, no.3, p.280-94 (July 1983).
Anova and 'dummy variables' least squares regression methods are used to investigate the dependence of ultrasound propagation velocity on the presence or absence of fat and on the rank ordered level of cirrhosis in fixed human liver. Cirrhosis is found to affect velocity in a nonlinear fashion, while fat depresses the velocities toward lower values. Quantifications of these effects and statistical analyses of their magnitudes are presented. The results represent a contribution toward the empirical understanding of the effects of tissue abnormalities on the velocity of ultrasound propagation in fixed human tissues. (16 refs.)

120953 History and state of the art of quantifying the interaction of electromagnetic fields with biological structures. A.W.Guy (Dept. of Rehabilitation Medicine, Univ. of Washington, Seattle, WA, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.781-815 (80 refs.)

120954 Theoretical and numerical methods for quantitfying absorption patterns in man and animal bodies. C.Yeh (Electrical Sci. & Engng. Dept., Univ. of California, Los Angeles, CA, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.817-33
Predicting theoretically the total electromagnetic power absorption and distribution of absorbed power in man and animal bodies is one the most challenging and important problems in electromagnetic biological effects research. The author starts with a survey of available analytical/numerical techniques which may be used to treat problems dealing with the interaction of electromagnetic waves and nonspherical three-dimensional dielectric bodies. Then, the two most promising methods are discussed in detail together with several illustrations. Finally, a discussion is presented on the future research prospects in this area. (15 refs.)

A waveguide pulse-echo system for ultrasonic absorption measurements in biological media .... See Entry 121080

87.50C Bioacoustics (sonic and ultrasonic effects on living matter)

120955 Sound levels recorded within the symphony orchestra and risk criteria for hearing loss. E.Jansson, K.Karlsson (Dept. of Speech Communication & Music Acoustics, Royal Inst. of Technol., Stockholm, Sweden).
Scand. Audiol. (Sweden), vol.12, no.3, p.215-21 (1983).
Investigations into noise-induced hearing loss should consist of two parts: a mapping of the sound environment and a charting of hearing loss. This paper is the first part of such an investigation: a mapping of sound levels and sound spectra within the symphony orchestra. It was found that 'heavy' symphonic music exceeds the permitted dose for industrial noise equivalent to 85 dB(A) for a full working week. The permitted noise dose is reached for 'heavy' music after a working time of 10 hours per week in 'exposed' positions, such as in front of trumpets, and after 25 hours in 'normal' positions. A simple method to estimate the 'noise' exposure in equivalent sound level for combinations of different sorts of music has been developed. (5 refs.)

120956 Errors due to signal cutoff in the measurement of sound intensity or sound-pulse dose. W.Kraak (Sektion Informationstech., Tech. Univ., Dresden, Germany).
Z. Elektr. Inf.- & Energietech. (Germany), vol.13, no.4, p.339-48 (1983). In German.
The measurement of sound in studies of the effects of intense sound on the ear, is considered for a particular model of sound pulse. Measurement errors are calculated for a range of insufficient modulation reserves. These errors are expressed as functions of the correct values, distinguishing between quadratic and linear measurement. (6 refs.) *F.Q.*

87.50E Bio-optics (effects of microwaves, light, laser and other electromagnetic waves)

120957 The effect of laser radiation on a dystrophic process in the liver caused by X-ray irradiation. A.K.Polonskii, S.I.Kharlampovich, D.D.Mashchanova, V.B.Potapova.
Med. Radiol. (USSR), vol.28, no.9, p.59-61 (Sept. 1983). In Russian.
A stimulating effect of a helium-neon laser (in single radiation for 5 min. daily) on a reparative process in the liver injured by X-ray radiation (in a single dose of 650) was studied by histological, cytophotometric and electron microscopic methods. It has been shown that after 3-20 sessions of laser therapy the architectonics of hepatic lobules regenerates, by the end of a therapeutic course a nearly complete regeneration of the intracellular structures of hepatocytes is noted. At the same time the level of nucleic acids and glycogen in the latter returns to normal. (7 refs.)

120958 Effect of light on the membrane potential of the cells of Neurospora crassa. T.A.Belozerskaya, M.S.Kritskii, T.V.Potapova, L.M.Chailakhyan (Bakh Inst. of Biochem., Acad. of Sci., Moscow, USSR).
Biophysics (GB), vol.27, no.5, p.955-7 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.5, p.910-11 (1982). [received: Sept. 1983]
Reports experiments on the changes in the value of the membrane potential of N. crassa on exposure to light of the blue-violet region. It was found that the membrane slowly hyperpolarised. (10 refs.)

120959 Focus on the non-ionising radiation. J.H.Skotte.
Elektronik (Denmark), no.6-7, p.4-8 (June-July 1983). In Danish.
The article deals with that part of the electromagnetic spectrum described as non-ionising. How such radiation arises, its effect on animals and human beings, which limit values should be used and how such radiation is measured. (no refs.) *H.J.P.*

120960 Sharp resonances in yeast growth prove nonthermal sensitivity to microwaves. W.Grundler (Gesellschaft fur Strahlen- und Umweltforschung, Neuherberg, Germany), F.Keilmann.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1214-167 (26 Sept. 1983).
Microwaves near 42 GHz are found to influence the growth of Saccharomyces cerevisiae. The growth is measured photometrically in stirred aqueous culture. The microwave effect occurs and saturates above a threshold intensity $\ll 10$ mW/cm^2, excluding any explanation based on microwave heating. A surprisingly strong frequency dependence is observed, with resonances as

narrow as 8 MHz. These results confirm the existence of a nonthermal resonant microwave sensitivity in biology; they suggest yet unknown tuned systems triggering yet unknown biological actions. (14 refs.)

Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute ....See Entry 116932

87.50G Ionizing radiations (u.v., X-ray, gamma-ray; particle radiation effects)

120961 Effect of X radiation on the number of pulmonary alveolar macrophages. B.Gnatowski, I.Koch (Military Inst. of Hygiene & Epidemiology, Warsaw, Poland).
Acta Physiol. Pol. (Poland), vol.33, no.3, p.151-6 (May-June 1982). [received: Sept. 1983]
Changes in the number and viability of pulmonary macrophages were studied after sublethal doses of X-rays to the whole body or selectively to the chest. A considerable fall in the total number of pulmonary macrophages was observed and the pattern of these changes was different after total body irradiation and after selective chest irradiation. The results suggest the possibility of selective damage by the X-rays to the precursor forms of pulmonary macrophages, and confirm the relationship between the number of pulmonary macrophages and the radiation dose. (14 refs.)

120962 Erythropoietic effect of ultraviolet radiation in blind rats in comparison with control seeing rats. M.Danieyko-Osman, E.Mietkiewski (Dept. of Physiology, Inst. of Physiology & Chem., Pomeranian Medical Acad., Szczecin, Poland).
Acta Physiol. Pol. (Poland), vol.33, no.3, p.169-77 (May-June 1982). [received: Sept. 1983]
In 40 blinded rats erythropoiesis parameters were determined in four groups of 10 animals each and were compared with similar parameters in seeing control rats. Two group of blind rats received ultraviolet radiation 405-289 nm wavelengths; 140000 erg/sec/cm^2 daily for 10 minutes during 2 or 4 weeks. Two other groups served as non-irradiated blind controls. The determined parameters showed the following rise (+) or fall (−) in per cent in relation to the non-irradiation rats: haematocrit (H) +3.6 and 9.3; erythrocyte count (E) +15.1 and 13.2; reticulocyte count (R) +65.5 and 184.1; haemoglobin level (Hb) +6.6 and 13.1; ^{59}Fe incorporation index into erythrocytes (EFe) +27.3 and 30.4, into spleen (SFe) +35.8 and 34.3, into liver (LFe) −20.9 and −19.3, into bone marrow (BFe) −22.8 and −41.9. In the seeing animals all these parameters were significantly greater: H +11.4 and 7.9; E +56.9 and 26.6; R +288.9 and 199.1; Hb +22.3 and 5.1; EFe +64.1 and 42.5; SFe +195.8 and 134.7; LFe −35.4 and −29.9; BFe −65.2 and −57.2. (12 refs.)

120963 Radiation pericarditis following therapy for Hodgkin's disease. G.D.Baisogolov, I.P.Shishkin, I.B.Shapiro.
Med. Radiol. (USSR), vol.28, no.9, p.27-31 (Sept. 1983). In Russian.
Cases of radiation pericarditis among 707 patients with Hodgkin's disease after irradiation of the mediastinum were analysed. In 100 patients irradiation was combined with polychemotherapy in cycles, SORR scheme. Radiation exudative pericarditis was noted in 2.6% of patients. Later on an adhesive process was diagnosed in some patients. Radiation pericarditis was accompanied either by feebly marked signs or no signs at all. In cases of a lingering course (over 24 mos.) of the disease surgical intervention is indicated. The frequency of radiation complications caused by pericarditis depends on the volume of irradiation and, to a lesser degree, on the value of a summary focal dose delivered to the heart within the range of 31-45 Gy. For prevention the heart should be shielded with lead blocks. (23 refs.)

120964 Effect of irradiation on the microviscosity of the nuclear membrane of tumour and liver cells of tumour bearing animals. Ye.L.Mal'tseva, A.N.Goloshchapov, N.P.Pal'mina, Ye.B.Burlakova (Inst. of Chem. Phys., Acad. of Sci., Moscow, USSR).
Biophysics (GB), vol.27, no.5, p.893-900 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.5, p.851-7 (1982). [received: Sept. 1983]
Reports changes in the microviscosity of the nuclear membranes of tumour and liver cells of tumour bearing animals with developing Ehrlich ascites carcinoma (EAC) at different times after exposure to lethal doses (650 R) by the spin probe method. Two nitroxide radicals were used mainly localized in the lipid bilayer and the near protein layers of the membrane lipids. The character and degree of the changes in microviscosity of the various regions of the nuclear membranes indicate the different response to the action of radiation of the cells of organs of the tumour bearers and the tumour both in viscous properties and in change in the lipid:protein ratios. The near-protein lipid layers were found to make an important contribution to the total change in the microviscosity of the nuclear membrane determining the difference in the reaction to radiation of the nuclear membranes of the liver cells of the tumour bearing and healthy animals and also considerable (3 fold) rarefaction of the nuclear membrane of the EAC cells after irradiation. It is shown that the temperature dependence of the rotatory correlation times of both probes is more marked in the EAC cells of the irradiated tumour bearing animals than in the liver. (28 refs.)

120965 Microbubble formation induced in organisms by irradiation. R.Kato.
Mem. Res. Inst. Sci. & Eng. Ritsumeikan Univ. (Japan), no.40, p.9-19 (1981).
In this paper radiobiological damage is discussed based on the theory of microbubble formation in an irradiated liquid. Calculations for the size and number of the microbubbles produced in a liquid are applied to those produced in the irradiated organisms. The effect of the micro-radiobiological damage depends on the size and location of the microbubble. The subsequent behaviors of the microbubble after formation in a cell is considered. From the calculations it is concluded that the microbubble formation in organisms by irradiation plays an important role in radiobiological damage. (16 refs.)

The RBE of the leakage radiation from the Hiletron neutron therapy unit ....See Entry 120947

The effect of laser radiation on a dystrophic process in the liver caused by X-ray irradiation ....See Entry 120957

Collective doses and risks from dental radiology in Great Britain ....See Entry 121012

87.60 MEDICAL AND BIOMEDICAL USES OF FIELDS, RADIATIONS, AND RADIOACTIVITY

(see also 28.80 Nuclear radiation technology, including shielding)

120966 Recent trends of medical image processing. M.Onoe.
Syst. & Control (Japan), vol.27, no.3, p.158-68 (March 1983). In Japanese.
Imaging based on CT technology has become paramount in the medical diagnosis field. X-ray scanning and diagnostic ultrasound equipment have shown impressive growth. Attention has been given to ultrasound tissue characterization, which allows greater accuracy in diagnosing tissue abnormalities. Digital radiography (DR) is becoming popular as a safe, cost-effective X-ray technology and is very suitable for use in angiography on an outpatient basis. DR can reduce the use of coronary cineangiograms and related catheters, etc. Nuclear magnetic resonance (NMR) is a radiationless imaging technique capable of visualizing the metabolic function of an organ (or lack of it) rather than a structure. NMR may become a universal imaging technique. This paper reviews today's aspect and the future trend in very high-speed CT, digital radiography, positron CT, NMR CT and ultrasound imaging. (2 refs.) *K.B.*

120967 Present status of medical imaging apparatus. M.Tsuda, H.Hattori.
Syst. & Control (Japan), vol.27, no.3, p.178-85 (March 1983). In Japanese.
Imaging equipment for medical applications utilizes X-rays, gamma-rays from a radioactive isotope, ultrasonic waves, or nuclear magnetic resonance (NMR). A brief description is given of X-ray television systems, digital fluoroscopy systems, X-ray CT imaging, scintillation cameras, emission CT imaging, ultrasonic equipment, and NMR imaging systems. Digital subtraction angiography (DSA) is establishing itself as a safe, cost-effective X-ray technology that provides physicians with a simplified method of examining blood vessels and the main organs they supply. The technique is noninvasive, requiring no catheterization (only a venous injection). With DSA's resolution continuing to improve coronary imaging will become possible. A combination of ultrasound and electronic scanning provides quantitative, accurate data and may represent the end generation of CT scanning and ultrasonic equipment. NMR is expected to join. The NMR technique holds great promise. (no refs.) *K.B.*

Recent topics in medical measurements ....See Entry 121043

87.60B Sonic and ultrasonic radiation

120968 Noninvasive method for detecting laryngeal narrowing with low-frequency sound. K.Sekizawa, C.Shindoh, W.Hida, S.Suzuki, Y.Akaizawa, Y.Shimizu, H.Sasaki, T.Takishima (First Dept. of Internal Medicine, Tohoku Univ. School of Medicine, Sendai, Japan).
J. Appl. Physiol. (USA), vol.55, no.2, p.591-7 (Aug. 1983).
Laryngeal narrowing was measured with low-frequency sound in human subjects. A low-frequency sound of 800 Hz was forced into the mouth, and sound-pressure amplitude above (SPAa) and below the vocal cord (SPAb) was detected using two separate microphones at the anterior neck. If the subject voluntarily narrowed the larynx at functional residual capacity, the increased respiratory resistance (Rrs) was only caused by increased laryngeal resistance, and SPAa was increased and SPAb was decreased. The percent changes of SPAa (SPAa%) minus that SPAb (SPAb%) from the initial values ($SPAa\%-SPAb\%=Y$) was proportional to the increase of Rrs from the initial control state (X, $cmH_2O.l^{-1}.s$); $Y=22.4\ X^{1.20}$ (coef. of correlation, $r=0.96$, $P<0.01$). The authors confirmed similar proportions in dogs by manually narrowing the vocal chord. When laryngeal resistance was directly measured by tracheal puncture with a needle, the proportions between Y and X were not significantly dependent on the increase of Rrs below the vocal cord induced by methacholine inhalation in human subjects and histamine injection in dogs. It is concluded that the increase of laryngeal resistance from the initial state can be detected noninvasively by using low-frequency sound. (22 refs.)

120969 Sounding the heart. A new acoustic therapy. W.Campbell.
Sci. Dimension (Canada), vol.15, no.4, p.23-7 (1983).
If the right amount of ultrasound energy is applied at just the right time, it can dramatically improve the performance of the heart when it is under stress. Early indications point to the same kind of effect in diseased or failing hearts as well. It is hoped that the ultrasound 'transducer' device, which converts electrical energy into ultrasound, can be used in the future to ease the effects of surgery on the heart. (no refs.)

120970 High speed tympanometry and ipsilateral middle ear reflex measurements using a computerised impedance meter. A.Ivarsson, O.Tjernstrom, A.Bylander, S.Bennrup (Dept. of Otorhinolaryngology, Univ. of Lund, Lund, Sweden).
Scand. Audiol. (Sweden), vol.12, no.3, p.157-63 (1983).
By means of a new computerized impedance meter, middle ear pressure, tympanograms and ipsilaterally elicited middle ear reflex can be recorded and presented in 3 sec. Owing to the fast rate of air pressure change in the external ear canal it is not necessary to have a completely airtight seal around the ear probe when recording middle ear pressure, which saves time. Results obtained using the new device and those obtained by a conventional impedance bridge are compared. (11 refs.)

120971 Comparison of manual and computer-controlled audiometry using identical procedures. L.Jerlvall, H.Dryselius, S.Arlinger (Dept. of Audiology, Univ. Hospital, Linkoping, Sweden).
Scand. Audiol. (Sweden), vol.12, no.3, p.209-13 (1983).
Ten normal-hearing subjects were evaluated with both manual and computer controlled audiometry using the ascending threshold determination method as proposed by ISO. The study shows that the thresholds obtained with the two different techniques correlate well and that standard deviations for the test-retest difference are significantly lower in the computer-controlled situation. The results also indicate that computer-controlled audiometry may be of importance in general clinical applications giving rapid and reliable threshold determination. (7 refs.)

120972 The selection of modulation rates for frequency modulated sound field stimuli. Walker G., H.Dillon (Nat. Acoustic Labs., Sydney, Australia).
Scand. Audiol. (Sweden), vol.12, no.3, p.151-6 (1983).
Frequency modulated (FM) tones are used in sound field audiometry in order to avoid problems caused by standing waves. The FM stimuli to be used must be specified in terms of bandwidth (twice the frequency deviation), modulation rate and modulation waveform. This paper deals with selection of the modulation rate. Improved field uniformity obtained with FM tones relies upon the ear avaraging the sound intensity as the frequency sweeps. The modulation rate must be less than about 1/3 of the frequency deviation in order to provide sufficient spectral components to ensure reasonable averaging across the frequency band. If the rate is too low threshold will be determined

by the peak intensity during the sweep. For normal listeners a modulation rate of 5 Hz is just satisfactory but in the hearing impaired a higher rate is required because of their altered temporal integration characteristics. A suitable value for the modulation rate can be inferred from the literature on temporal integration and the acoustic characteristics of typical test rooms. The optimum rate increases with the stimulus centre frequency, but a constant rate of 20 Hz appears to be acceptable. (17 refs.)

120973 Generation of separate density and compressibility images in tissue. S.J.Norton (Center for Materials Sci., NBS, Washington, DC, USA).
Ultrason. Imaging (USA), vol.5, no.3, p.240-52 (July 1983).
A method is suggested for reconstructing separate images of the variations in density and compressibility in the same tissue sample. The images can be obtained from near-field scattering measurements using only two long, rectangular transducer elements. As in diffraction tomography, 180° access around the region of interest is required. This approach differs from conventional diffraction tomography, however, in that no transducer arrays are required and broadband illumination is used. A flat transducer, assumed long relative to the extent of the object, is used as a source of broadband, plane-wave illumination, and as a receiver of the backscattered sound. A sound transducer, oriented at a different angle with respect to the first, is used as a receiver only. The two transducers are rotated together 180° around the object, and the scattered sound is recorded at all angles during the rotation. This arrangement can be shown to sample the plane-wave spectrum of the object directly, and provides sufficient information to reconstruct independent images of the variations in both the density and compressibility of the scattering medium. Image resolution is limited by the bandwidth of the illuminating sound. (13 refs.)

120974 Real time ultrasonic imaging with arrays. J.G.Abbott, K.E.Thomenius (Elscint Inc., Boston, MA, USA).
Electro/82 Conference Record, Boston, MA, USA, 25-27 May 1982 (El Segundo, CA, USA: Electron. Conventions 1982), p.15-1/1-6
The history and present use of array system technology for real-time ultrasonic imaging in a medical environment is discussed. Array systems presented include the wide aperture switched linear array, the electronically steered and focused phased linear array and the mechanically steered, electronically focused annular array. Practical and theoretical advantages and disadvantages of each approach are compared and the unique problems of implementation of each are presented. This analysis concludes with a brief discussion of future real-time array imaging modalities. (30 refs.)

Conception and realization of a photoacoustic detector for in situ spectroscopy ....See Entry 117248

A three dimensional model for generating the texture in B-scan ultrasound images ....See Entry 118329

Changes in myocardial backscatter throughout the cardiac cycle ....See Entry 120951

Diagnostic potential of magneto-photoacoustic spectroscopy .See Entry 120976

Rational gain compensation for attenuation in cardiac ultrasonography ....See Entry 121048

The improvement and quantitative assessment of B-mode images produced by an annular array/cone hybrid ....See Entry 121086

87.60D Electric and magnetic fields (d.c. and pulsed)

120975 A new magnetic method for studying the quality of lung-retained dust in vivo. K.Kalliomaki, P.-L.Kalliomaki, M.Moilanen.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.72-5 (1983).
Workers in the metal industry are exposed to fumes which nearly always contain iron (magnetite). If the worker's exposure is homogeneous the amount of lung-retained dust can be estimated from the remanent magnetic field of the dust after the chest area has been magnetized. In most cases, however, the worker's exposure is heterogeneous. For example, a welder often uses several welding methods that generate fumes which differ from each other. Then the old measuring method does not reliably reveal the actual character of the contaminants retained in the lungs. By utilizing pulse magnetization and demagnetization, one can measure the pulse coercive force of the lung retained contaminants. The results of preliminary measurements showed that stainless steel workers can be divided into three groups, i.e. the quality of the dominating lung retained contaminants can be determined with the aid of the pulse coersive force. (4 refs.)

120976 Diagnostic potential of magneto-photoacoustic spectroscopy. R.Carey, D.M.Newman, B.W.J.Thomas (Dept. of Appl. Phys., Coventry Polytech., Coventry, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.35-40 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Describes a magneto-photo-acoustic spectroscopic (MPAS) technique which the authors claim will prove to be more sensitive than the reflectivity measurements of Sato et al. (1981) in sensing the presence of malignant diseases in blood. The authors begin by describing the magnetic properties of blood cells, illustrating how the combined expertise of magneticians and haematologists has been successfully applied to the problem of red blood cell separation. The authors then briefly review the reported application of PAS to medical problems including the spectral analysis of whole blood, and finally the authors present the details of preliminary experimental measurements on the MPAS signal from whole blood at the He-Ne wavelength. (8 refs.)

A computerized mass spectrometer and flowmeter system for respiratory gas measurements ....See Entry 121029

87.60G Laser beams, microwaves, and other electromagnetic waves

(inc. NMR; for X-rays and gamma-rays, see 87.60J)

120977 Eye deformation measurement by laser interferometry. A.F.Fercher, J.D.Briers (Univ. of Essen, Fachbereich Phys., Essen, Germany).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.42-4 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A new interferometric technique to measure deformations of the eye in vivo is described and its application to the diagnosis of glaucoma is discussed. (6 refs.)

120978 Double pulsed holographic interferometry on human beings in vivo. M.H.De Caluwe, P.M.Boone (Lab. for Strength of Materials, Univ. of Ghent, Ghent, Belgium).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.596-603 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The use of a pulsed ruby laser in recording holographic interferograms of specific surface displacements of the human body is demonstrated. Technical particularities of the technique are discussed and attention is paid to the safety requirements of the measurement method. (15 refs.)

120979 Non-invasive microwave monitoring of respiratory pattern. N.Ambrosino (School 'Terapisti della riabilitazione', Pisa, Italy), M.Bramanti.
J. Med. Eng. & Technol. (GB), vol.7, no.5, p.224-7 (Sept.-Oct. 1983).
A non-invasive system for monitoring chest and abdominal motion is described. The system is based on the use of two microwave interferometers. A linear relationship with tidal volume can be obtained using an isovolume technique for calibration. Although the system is not an improvement on existing equipment, it is simpler and cheaper and well suited to rehabilitation work. (20 refs.)

120980 A variable pulse-burst electromagnetic generator for electrical stimulation of biological systems. G.N.Reddy, S.Saha (Dept. of Orthopaedic Surgery, Louisiana State Univ. Medical Center, Shreveport, LA, USA).
J. Biomed. Eng. (GB), vol.5, no.4, p.336-9 (Oct. 1983).
A variable frequency-burst type, electromagnetic pulse generator has been developed to optimize the effect of electrical stimulation on bone growth. Using a pair of coils, with 100 turns and 18-gauge wire, the instrument can generate a maximum magnetic field of 300 Gauss. Its pulse repetition frequency can be varied from 10 Hz to 2 kHz and the duty cycle, consisting of several short carrier frequency pulses, can be varied up to 95%. This design also permits the period of the carrier pulse to be changed. (16 refs.)

120981 Nuclear magnetic resonance blood flow measurements in the human brain. J.R.Singer, L.E.Crooks (Dept. of Electrical Engng. & Computer Sci., Univ. of California, Berkeley, CA, USA).
Science (USA), vol.221, no.4611, p.654-6 (12 Aug. 1983).
Timed sequences of nuclear magnetic resonance imaging signals in the human head were used to quantitatively measure blood flow in the internal jugular veins. The procedure can be straightforwardly applied to any vein or artery in the body. (11 refs.)

120982 Nuclear magnetic resonance imaging: an overview. I.L.Pykett (Dept. of Radiology, Massachusetts General Hospital, Boston, MA, USA).
Electro/82 Conference Record, Boston, MA, USA, 25-27 May 1982 (El Segundo, CA, USA: Electron. Conventions 1982), p.15-2/1-3
Today's 'state-of-the-art' NMR images compare favorably with X-ray computerized tomography (CT) scans, especially in terms of soft tissue contrast resolution; the next few years will undoubtedly witness a rapid expansion of its applications to clinical practice. One particular advantage of NMR imaging over X-ray CT is that it is inherently a three-dimensional technique. (10 refs.)

120983 A microscope-television system for online measurement of blood flow velocity in microvessel using an adaptive window. Jin Qi Yin, Zhang Ju Peng, Zhang Zhi Guang, Liu Ting Wen, Tang Yu, Wang Zhong Rui, Zhong Kong De (Dept. of Electrical Engng., Tsinghua Univ., Beijing, China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.327-37
A system which is used for on-line measurement of the blood flow velocity in microcirculation is introduced. The system is characterized by an adaptive window which coincides with the microvessel to be tested. Two ways of measuring the blood velocity are analog processing method; and digital correlation method. About a hundred cases of clinical experiment have been carried out which show that this system is very useful for the study of microcirculation. Simulation test for blood flow indicates that the linearity error of the system is less than 5% and the velocity can be measured over a range of 0-4 mm/sec. (6 refs.)

120984 Medical diagnosis and imaging using electromagnetic techniques. M.F.Iskander, C.H.Durney (Dept. of Electrical Engng., Univ. of Utah, Salt Lake City, UT, USA).
Theoretical Methods for Determining the Interaction of Electromagnetic Waves with Structures. Proceedings of a NATO Advanced Study Institute, Norwich, England, 23 July-4 Aug. 1979 (Alphen aan den Rijn, Netherlands: Sijthoff & Noordhoff 1981), p.835-54
Presents a brief review of the potential electromagnetic (EM) methods for medical diagnosis and imaging. This includes electrical impedance methods, microwave methods for measuring lung water content, and electromagnetic imaging. The principles underlying the operation of each method are described along with comments about their adequacy for medical diagnosis. It is shown that while the microwave method was introduced to overcome some of the limitations of the electric impedance method, its potential to estimate the absolute value of the average lung water content still needs further research. Electromagnetic imaging, on the other hand, is expected to overcome some of the difficulties involved in the microwave method. The important theoretical and experimental results that identify the advantages and the limitations of each method are presented. Suggestions for future development and for possible extensions are discussed. Furthermore, other techniques such as microwave radiometry, the electromagnetic flowmeter, and use of microwave Doppler radar to monitor arterial wall movement, are briefly mentioned. (36 refs.)

Laser 83 Opto-Elektronik. 6th International Congress and International Trade Fair (papers in summary form only received) ....See Entry 116929

A new integrating raster microdensitometer ....See Entry 117208

Conception and realization of a photoacoustic detector for in situ spectroscopy ....See Entry 117248

The geometric and Fourier transform solutions for the object-image conjugated interference field of human retina in the visual acuity examination by laser interferometry ....See Entry 120842

Laser speckle technique for the visualization of retinal blood flow ....See Entry 120849

Diagnostic potential of magneto-photoacoustic spectroscopy .See Entry 120976

Laser heating of thermoluminescent microdosimeters: prospects in application to imagery by ionizing radiations ....See Entry 121015

87.60J Corpuscular radiation and radioisotopes

(inc. X-rays and gamma-rays)

120985 Medical therapy with π^- mesons. E.Walder (Schweizerisches Inst. fur Nuklearforschung, Schweiz, Germany).
Atomkernenerg. Kerntech. (Germany), vol.42, no.3, p.165-8 (1983).
Physical and biological aspects led to the realization of cancer therapy with π^- mesons. The pions are produced by collision of the protons with target material. They are focused into the treatment volume. Two methods are developed to scan this volume in a 3-dimensional way. The dosimetric system has to take into account that the dose contains spatially mixed LET contributions. CT-slices of the patient serve as a basis for therapy planning. As experience grew, deeper lying tumors were treated. The expectations of the project have recently beeen accomplished. Even so, it is too early to make conclusive statements about clinical data; however, the results permit one to look optimistically into the future. (12 refs.)

120986 Computer-aided tomography in the determination of lung density in irradiation planning. K.Merkle, O.N.Spasokukotskaya, S.E.Evdonin.
Med. Radiol. (USSR), vol.28, no.9, p.31-4 (Sept. 1983). In Russian.
Considers the problems of the determination of lung density in irradiation planning for thoracic tumors using CT. A mean value of density of 0.252 ± 0.118 g/cm^3 was obtained from a study of 118 CT lung scans during quiet breathing. The density was 0.162 ± 0.022 g/cm^3 in deep breathing and 0.282 ± 0.050 g/cm^3 in full expiration. The values of lung density varied in different persons. The range of measured values was 0.119-0.441 g/cm^3 in quiet breathing. The values of lung density varied within one scan from a minimum value in its front part to a maximum one in the rear part. To determine lung densities that are representative for radiation therapy, the authors conclude that CT should be performed with a patient breathing quietly in an uninterrupted manner. (12 refs.)

120987 Radionuclide studies on ventilation and perfusion in different lung regions. A.I.Sorokin, B.Ya.Narkevich, Yu.B.Bogdasarov, T.I.Zaitseva.
Med. Radiol. (USSR), vol.28, no.9, p.42-7 (Sept. 1983). In Russian.
At present when using radionuclide methods for investigation of lung ventilation and blood flow one mistakes either a regional ventilated volume or the rate of indicator clearance from a given region for regional alveolar ventilation. The regional ventilation-perfusion ratio is obtained by dividing corresponding values expressed not in absolute but in relative units that causes erroneous results. A method proposed in this paper makes it possible to calculate regional distributions of ventilation, perfusion and their ratio in terms of values of the mean time of the passage of an indicator through the alveolar-bronchial space and the vascular bed of the lungs, strictly in accordance with the conditions of the clinical physiology of respiration. Measurements are taken according to an established method using either a γ-chamber or a radiographic unit with autonomous detectors. (10 refs.)

120988 A phantom to assess quantitative recovery of positron tomographs. B.E.Cooke, A.C.Evans (Atomic Energy of Canada Ltd., Kanata, Ontario, Canada).
J. Comput. Assisted Tomogr. (USA), vol.7, no.5, p.876-80 (Oct. 1983).
A simple phantom has been employed to investigate the image linearity for a wide range of activity distributions and count rates. The phantom is composed of two activity regions, one contains a short-lived isotope and the other a long-lived isotope. Specifically, the phantom consists of a 20 cm flood phantom containing ^{68}Ga (half-life 1.14 h) into which a 6 cm diameter cylinder containing ^{64}Cu (half-life 12.7 h) is placed in an off-centre position. The copper region is initially a cold spot but, after many gallium half-lives, becomes a hot spot. Successive data sets from the phantom are taken over a long period and the reconstructed images analysed to establish the linearity within each region and hence the stability against 'cross-talk' from neighbouring regions. (9 refs.)

120989 Artifact simulating chronic extracerebral fluid collections on computed tomography of the head. T.T.Loh (Dept. of Radiology, St. Vincent Hospital & Medical Center, Toledo, OH, USA).
J. Comput. Assisted Tomogr. (USA), vol.7, no.5, p.925-7 (Oct. 1983).
Accurate analysis in computed tomography of the brain requires recognition of artifacts that may lead to an erroneous diagnosis or at least confuse the examination. An artifact that mimics chronic extracerebral fluid collections is described; it can occur with the Picker 600 scanner. One should be aware that an artifact can be machine specific, depending on the reconstruction and design differences of the scanner. (4 refs.)

120990 Tungsten anode tubes with K-edge filters for mammography. S.Beaman, S.C.Lillicrap (Wessex Regional Medical Phys. Service, Bath, England), J.L.Price.
Br. J. Radiol. (GB), vol.56, no.670, p.721-7 (Oct. 1983).
Filters having absorption edges at appropriate energy positions have been used to modify the shape of tungsten anode spectra to bring them close to the calculated optimum. The suitability of such spectra for practical use has been assessed by comparing both the film image quality and the incident breast dose obtained using a K-edge filtered tungsten anode tube with that obtained using a molybdenum anode tube. Image quality has been assessed both by using a 'random' phantom and by comparing mammograms of women attending a screening clinic where one breast was radiographed using a filtered tungsten anode tube and the other using a standard molybdenum anode unit. Relative breast doses were estimated. The film image quality assessment indicated that the filtered tungsten anode tube gave results which were not significantly different from those obtained with a molybdenum anode tube for a tissue thickness of about 4 cm and which were better for larger breast thicknesses. The dose could be reduced to between one-half and one-third with the filtered tungsten anode tube. (15 refs.)

120991 Preliminary clinical images from a prototype positron camera. R.J.Ott, J.E.Bateman, A.C.Flesher, M.A.Flower, M.O.Leach, S.Webb, O.Khan, V.R.McCready (Inst. of Cancer Res., Sutton, England).
Br. J. Radiol. (GB), vol.56, no.670, p.773-6 (Oct. 1983).
Presents preliminary clinical images taken during an evaluation of a prototype multiwire proportional chamber positron camera. Although these early images were taken with a limited sensitive area, a camera with a larger field of view is currently being developed. Such a positron camera would be used with generator-produced as well as cyclotron-produced longer-lived positron emitting radionuclides to provide a PET system at a price competitive with present day gamma camera/computer systems. The small useful sensitive area of the prototype positron camera only enabled limited regions of the body to be imaged. However, it proved possible to produce satisfactory images of these limited regions of the torso. The detector proved most suitable for imaging the skull, brain, thyroid and limbs. (6 refs.)

120992 Real time digital intravenous angiography. J.P.Marc-Vergnes, B.Thiesse (Centre Hospitalier Univ. Purpan, Toulouse, France), M.Adelantado, M.Ducos de Lahitte, P.Marthon, A.Bruel.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.136-40 (1983). In French. (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
As the computer technique, the CT scan, has recently induced great changes in both medical and radiological practice, photoelectronic detection of X-rays and digital image processing are just beginning to improve angiocardiography. The first generation of intravenous angiography systems is presently available. They allow one to visualize the chambers of the heart as well as the great arteries using a fast intravenous injection of contrast medium. In the future, this technique will probably be suitable for visualizing the entire vascular network, including small arteries and veins, and other cavities such as urinary and digestive tracts. In the long term, a large increase in computer assisted diagnostic techniques is likely to occur, as well as the suppression of the film support. (8 refs.)

120993 Acquisition of organ slice images in nuclear medicine by the multiple-incidence technique. B.Danet, A.Hatzigiannaki (Service de Biophys. et Medecine Nucleaire, Hopital Purpan, Toulouse, France), M.Percheron, J.P.Morucci, R.Guiraud.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.141-7 (1983). In French. (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
In the development of devices to represent the three-dimensional structure of radio-activated organs, nuclear medicine has been following the progress in radiology. The multiple-incidence technique, the 3D reconstruction being extracted from the whole set of projections of the object at different orientations, is close to the principle used in radio-tomo-densitometry. A detector obtains a set of projections as it turns around the object. From these projections, the classical reconstruction algorithms can be used: ART, SIRT, convolution algorithms. One has to take into account here some more specific properties: the statistic noise, the selfattenuation of the radiation, the distance-dependent resolution. Some correction processes are considered which can be more or less easily implemented depending on the algorithm used. Different compromises can be proposed: they depend strongly not only on the algorithm and the data-processing but also on the detector performance. (13 refs.)

120994 Numerical method of 'adapted' deconvolution: application to the tomography by coded aperture. P.Marthon, P.Bon, A.Bruel (LSI, Univ. Paul Sabatier, Toulouse, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.148-53 (1983). In French. (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
The discrete formulation of a coded-aperture image is recalled; the principle of the numerical convolution is given and then a maximum value is calculated for the quadratic error. The advantages offered by a post-deconvolution filtering as well as by an iterative restoration of the slices are shown. Finally the results obtained by reconstructing an object consisting of three slices which is a coarse model of the human heart are presented. (5 refs.)

120995 Computer generated 3-D display of X-ray computed tomographic volume image data. L.D.Harris, E.L.Ritman, R.A.Robb (Dept. of Physiology and Biophys., Mayo Clinic and Mayo Found., Rochester, MN, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.176-81 (1983). (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
The use of two computer-based, multi-dimensional display methods to efficiently convey three-dimensional (3-D) anatomic information contained within computed tomographic (CT) volume images is described. The term volume image refers to a stack of discrete 2-D CT images and is therefore a 3-D array of volume picture elements (voxels). The first display method is referred to as a direct display approach because it directly represents the 3-D volume image array as a 3-D distribution of brightnesses, i.e. each voxel is a brightened point in space. The second display method is referred to as a transformed display approach meaning that before display, the volume image data are transformed resulting in a new image data set which then forms the basis of the display process. An example of transformed display is shaded surface display, where the transformation is the detection and subsequent representation of the 'surface' as a 3-D distribution of reflectors. These display approaches facilitate the direct visualization of 3-D shapes and spatial relationships thereby obviating the necessity of mentally reconstructing shapes from the series of cross sections. (9 refs.)

120996 Attainment of 3-D images in nuclear medicine by coded-aperture devices. D.Lefkopoulos, B.Danet, J.B.Guilhem (Service de Biophys. de Medecine Nucleaire, Hopital Purpan, Toulouse, France), J.P.Morucci, R.Guiraud.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.188-94 (1983). In French. (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
After a quick survey of previous papers on coded-aperture work in nuclear medicine, the authors present the first results they have obtained with a code originating from the Fresnel zoned array—the Fresnel zoned linear array—the numerical simulation of the diffraction phenomena being used as the reconstruction method. In the case of the circular Fresnel zoned array the numerical reconstruction necessitates a two-dimensional Fourier-transform. On the contrary the Fresnel linear array necessitates a Fourier transform in one dimension only; so it becomes possible to use this method with the processing equipment frequently available in nuclear medicine facilities. The experimental results obtained have allowed the focusing-properties of this code (tomographic effect) to be verified and also to show that the values obtained by numerical reconstruction agree with those given by the theory of optics. (24 refs.)

120997 Study of methods of 3-D reconstruction in radiography. F.Peyrin, P.Wetta, R.Goutte, M.Amiel (Lab. de Traitement du Signal et Ultrasons, INSA de Lyon, Villeurbanne, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.208-15 (1983). In French. (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
In the field of X-ray radiography, different three-dimensional reconstruction techniques have been proposed: apart from computer-aided tomodensitometric methods one can reconstruct an object by using the different slices which are obtained by the now classic scanner. Nevertheless, it is also possible to consider that problem more directly, by using a set of planar projections. In the parallel-beam geometry a set of projections obtained by the rotation of the beam in a plane is sufficient to reconstruct the 3-D object. This method meets technological difficulties as it is difficult to have a parallel-beam with a large cross-section. This fact has led the authors to consider the use of a conical beam. This causes further technological and practical difficulties due to the generally limited possibilities in the positioning and the displacement of the X-ray sources. One is thus inevitably led to use measurements originating in a

system based on the cone-beam geometry whose axis rotates only in one plane. Thus, this axial symmetry will cause a certain number of problems which are in fact the consequence of the limited knowledge of the information. Possible solutions are suggested. (18 refs.)

120998 Study of optimal reconstruction techniques in the field of X-ray tomodensitometry of the heart. P.Wetta, F.Peyrin, R.Goutte, M.Amiel (Lab. de Traitement du Signal et Ultrasons, INSA de Lyon, Villeurbanne, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.216-29 (1983). In French. (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
Computerized-aided tomodensitometry by X-rays is a powerful, precise and noninvasive tool to investigate the human body as well as different objects and structures. The relatively long examination time, from 2 to 10 sec., which the present state of the art necessitates, limits the field of applications of this tool to static on quasistatic organs or objects (e.g. the brain or abdomen in medical diagnosis). When one tries to reconstruct images of a dynamic object some errors or artefacts appear. In the case of the heart, in particular, the examination time takes several cardiac periods; so, the reconstructed image is highly blurred and for all purposes unusable. One solution, which can be used with a conventional scanner, is the 'gating' technique. Taking into account the repetitive property of cardiac movement, this technique necessitates catching the projections in synchronization with the electrocardiogram. Thus a subprogram, controlled by the ECG signal, has to select a set of projections corresponding to a certain time of the cardiac period. The authors discuss the methodology used to acquire the projections, the problems caused by the small number of projections, some mathematical solutions (extensions of signals and data, interpolations, uses of the redundancy in the information given by a FAN-BEAM system). The different possibilities are illustrated by results obtained in experiments on animals with a FAN-BEAM machine. (4 refs.)

120999 Radiation risk of thyroid scintigraphy in newborns. H.Beekhuis, D.A.Piers (Dept. of Nuclear Medicine, Univ. Hospital, Groningen, Netherlands).
Eur. J. Nucl. Med. (Germany), vol.8, no.8, p.348-50 (1983).
Tumor risk factors were calculated for newborns who were investigated for congenital hypothyroidism (CHT) with radionuclides by thyroid scintigraphy. Figures for three radiopharmaceuticals, ^{99m}Tc-pertechnetate, ^{123}I- and ^{131}I-sodium iodide for adults were extrapolated to newborns. The radiation dose to the normal thyroid gland in newborns was seven times higher for ^{123}I-NaI than for $^{99m}TcO_4^-$, the somatically effective total body dose was two times higher for ^{123}I-NaI than for $^{99m}TcO_4^-$. The use of ^{123}I-NaI was preferred because of better scintigraphic results. Risk estimates for thyroid scintigraphy in newborns in the diagnostic work-up of CHT are given using published age-dependent tumor induction figures derived from atomic bomb survivors. (15 refs.)

121000 A method of quantitative ^{67}Ga scintigraphy in the evaluation of pulmonary sarcoidosis. J.G.van Unnik, E.A.van Royen, C.Alberts, J.B.van der Schoot (Dept. of Nuclear Medicine, Univ. of Amsterdam, Amsterdam, Netherlands).
Eur. J. Nucl. Med. (Germany), vol.8, no.8, p.351-3 (1983).
^{67}Ga scintigraphy was performed in 42 patients with pulmonary sarcoidosis and in 30 control subjects. Accumulation of the radionuclide in hili and lungs was quantified by a computer method. The values in control subjects were found to be within a relatively narrow range. The pattern of ^{67}Ga accumulation clearly differed in patients who were radiographically defined as having only lymphadenopathy and in patients also having parenchymal involvement. Corticosteroid therapy resulted in a sharp decline of values of isotope uptake, although hilar activity remained slightly elevated. The quantitative uptake measurement proved to be superior to a subjective scoring method. (8 refs.)

121001 Quantitative, non-invasive cerebral blood flood flow measurements with non-diffusible tracers using a heart-rate-dependent recirculation correction—application in carotid surgery. P.Lindner (Municipal Hospital Passau, Dept. of Radiology, Passau, Germany).
Eur. J. Nucl. Med. (Germany), vol.8, no.8, p.358-63 (1983).
A general method is described for computation of blood flow from time-activity curves using intravenous injection of the non-diffusible radio-tracer technetium pertechnetate. A technique of recirculation correction is adopted which predicts the start and end of recirculation depending on the patient's heart rate. This method allows one to clearly separate the first transit from the following recirculation. A correction for bolus dispersion of the intravenously injected tracer is also used. The evaluation of cerebral dynamic perfusion studies in 126 unselected adult patients resulted in a normal CBF of 44.5 ml/min/100 g±5% and a decreased CBF of less than 40 ml/min/100 g. The method presented was also applied for flow measurement on the neck vessels. A good correlation between values obtained from these regions and the corresponding cerebral hemispheres, was found. The method was also tested in 40 patients with angiographically proven neck vessel stenosis and in 15 patients before and after surgery of carotid stenosis. The results prove that the haemodynamic relevance of carotid stenosis on cerebral blood flow can be quantified. (16 refs.)

121002 Comparative CT examination of the anterior crucial ligament in direct projection and by means of sagittal reconstruction. K.Meydam, M.Kessler, R.Muller-Rensing, G.Fund (Abteilung fur Radiologie des Knappschafts-Krankenhauses, Dortmund, Germany).
Roentgen-Bl. Prax. & Klin. (Germany), vol.36, no.8, p.244-7 (Aug. 1983). In German.
Presents an indirect method for the visualization of the anterior crucial ligament, using the method of sagittal reconstruction. Positioning in the so-called tailor's seat is often impossible in freshly injured persons. The abdominal positioning described in this article, with external rotation of the leg, is tolerated by almost all patients. Sagittal reconstruction yields adequate information in fresh lesions and if there is an obstruction to bending. However, this method is diagnosticaly not as infallible as direct visualization. The authors discuss whether additional reconstructions on different planes and with pixels of different thickness (so-called thick pixel reconstruction) may be able to contribute to improved diagnostic results in future. In addition, the authors compare their own examination results with normal and pathological findings published by other authors. (12 refs.)

121003 Standardization of ^{18}F for use in positron-emission tomography. B.M.Coursey, D.D.Hoppes, M.P.Unterweger (Radioactivity Group, NBS, Washington, DC, USA), A.Grau Malonda, R.A.Margolin, R.M.Kessler, R.Manning.
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1181-9 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
Fluorine-18 has been standardized using three counting systems: (i) the NBS pressurized '4π'γ ionization chamber, (ii) a $4\pi\beta$ liquid-scintillation counter, and (iii) a Ge(Li) gamma-ray spectrometer previously calibrated with sodium-22. The results of the three measurements agreed to within 1 percent. Solution standards of fluorine-18 were used at the NIH to calibrate counting systems used in positron-emission tomography for nuclear medicine. (5 refs.)

121004 A conceptual design of neutron tumor therapy reactor facility with a YAYOI based fast neutron source reactor. H.Wakabayashi (Nuclear Engng. Res. Lab., Univ. of Tokyo, Tokyo, Japan), S.An.
J. Fac. Eng. Univ. Tokyo Ser. B (Japan), vol.37, no.1, p.123-33 (March 1983). [received: Oct. 1983]
Fast neutrons are known as one of the useful radiations for radiation therapy of tumors. Boron neutron capture therapy (BNCT) of tumors which makes use of $^{10}B(n,\alpha)^7Li$ reaction of ^{10}B compounds selectively attached to tumor cells with thermal and intermediate neutrons is another method of neutron based radiation therapy which is, above all, attractive enough to kill tumor cells selectively sparing normal tissue. In Japan, BNCT has already been applied and found to be effective. A conceptual design of a special neutron therapy reactor facility based on YAYOI—fast neutron source reactor of Nuclear Engineering Research Laboratory, Faculty of Engineering, the University of Tokyo—modified to provide an upward beam of fast and intermediate neutrons is presented. Emphasis is placed on the in-house nature of the facility and on the coordinating capability of biological and physical researches as well as maintenance of the facility. (9 refs.)

121005 Large format X-ray image intensifier for lung investigations. R.Frank, F.W.Hofmann, S.Schweda (Siemens AG, Erlangen, Germany).
NTG-Fachber. (Germany), vol.85, p.176-81 (1983). In German. (Elektronenrohren (Thermionic Valves), Garmisch-Partenkirchen, Germany, 18-20 May 1983).
The new Siemens electron-optical X-ray tube has a 57 cm input field diameter, allowing lung imaging with minimum irradiation; it is suitable for the indirect method. The design of the tube, its vacuum enclosure, X-ray transparent window and projection with 5.7:1 reduction are described in some detail. The amplification is sufficient to expose a 100×100 mm^2 film with an irradiation of 100 μR. Some performance data are given. (5 refs.) *J.M.S.*

121006 Pions against cancer. New tumour therapy at UBC. B.Atkinson.
Sci. Dimension (Canada), vol.15, no.4, p.12-16 (1983).
TRIUMF, a great cyclotron in Vancouver supported by NRC, is now producing a different kind of radiation for use against cancer. TRIUMF accelerates hydrogen ions to respectable fractions of the speed of light. At one point in the spiral these ions describe during their acceleration, TRIUMF's technicians have positioned a thin piece of metal foil which strips the electrons from some of the fast-moving ions, changes their charge, and sends them hurtling along a pipe at a tangent to their prior spiral course. Halfway down this pipe the particle beam, now composed of pure protons, smashes into a target of carbon or beryllium and produces pions. These pions continue the rest of the way down the pipe to the treatment centre and irradiate patients with deep tumours of the pelvis or brain. Pions have what is called a 'depth-charge effect'—they cause less damage than conventional radiation does to intervening healthy cells, yet deliver up to 40 per cent more energy at the tumour site. Essentially, one first calculates the exact point where the pi-mesons will become unstable enough to react strongly with surrounding matter and positions the patient carefully where the pions will 'emerge'. Patients are exposed to the pion beam for only twenty minutes at a time. Given the beam's intensity, this duration is quite safe; the time limit is imposed not by radiation hazard but by the patients' comfort. (no refs.)

Tomographic reconstruction from a limited number of projections .... See Entry 117295
Processing system for radiographic pictures .... See Entry 117296
Applications of 3-D nuclear scattering radiography in technology and medicine .... See Entry 120520
Pressures during retrograde pyelography .... See Entry 120876
The RBE of the leakage radiation from the Hiletron neutron therapy unit .... See Entry 120947
Radiation pericarditis following therapy for Hodgkin's disease .... See Entry 120963
Accelerator production of medically useful radionuclides .... See Entry 121007
Dosimetric characteristics of ^{125}I encapsulated sources for interstitial radiation therapy .... See Entry 121008
Gastrointestinal fluoroscopy: patient dose and methods for its reduction .... See Entry 121009
A refinement to a radiation dose reduction modification for an EMI CT 5005 whole body scanner filtration system .... See Entry 121011
Collective doses and risks from dental radiology in Great Britain .... See Entry 121012
Dose levels outside radiotherapy beams .... See Entry 121013
Used requirements on CT-based computer dose planning systems in radiation therapy: presentation of 'check lists' .... See Entry 121014
Laser heating of thermoluminescent microdosimeters: prospects in application to imagery by ionizing radiations .... See Entry 121015

87.60L Preparation of radioactive materials for medical and biomedical uses

121007 Accelerator production of medically useful radionuclides. G.Pfeiffer (Inst. fur Reaktorforschung, Wurenlingen, Germany).
Atomkernenerg. Kerntech. (Germany), vol.42, no.3, p.169-73 (1983). In German.
The production of radionuclides in accelerators has become of increasing importance during the last years, because these nuclides fulfil the demands for tracers as they are used for diagnostic purposes. Most of them are produced by bombardment with hydrogen or helium nuclei in cyclotrons. The kind of particles, their energy and the beam intensity determine the production rate. Some of these radionuclides are already used for routine work in the departments of nuclear medicine (^{67}Ga, ^{201}Tl), others will be applicable soon (^{81m}Kr, ^{127}Xe). One of the most versatile radionuclides is ^{123}I since it qualifies for labelling many substances of medical concern. Since 1975 it is permanently produced in abundance in Switzerland. (19 refs.)

87.60M Radiation dosimetry

121008 Dosimetric characteristics of ^{125}I encapsulated sources for interstitial radiation therapy. A.A.Volkov, O.N.Pereletov, R.V.Sinitsyn, V.M.Zaitsev, E.G.Alekseev, S.M.Vatnitskii, I.S.Osipov.
Med. Radiol. (USSR), vol.28, no.9, p.68-70 (Sept. 1983). In Russian.
Thermoluminescent dosimetry using Mix-D material was applied to study the dosimetric characteristics of discrete sources in the form of titanium and nylon capsules, sizes 0.8×2.5 and 1.7×7 mm, with an activity of 20-40 MBK. Dose field parameters were permissible within the limits of volume subject to radiotherapy. There was a higher dose gradient beyond the field

limits as compared to ^{226}Ra, ^{198}Au and ^{192}Ir. It is concluded that manufactured ^{125}I discrete sources meet the requirements of interstitial radiation therapy in the protracted tumor irradiation mode. (2 refs.)

121009 Gastrointestinal fluoroscopy: patient dose and methods for its reduction. S.J.Leibovic, W.J.H.Caldicott (Dept of Radiology, Children's Hospital, Boston, MA, USA).
Br. J. Radiol. (GB), vol.56, no.670, p.715-19 (Oct. 1983).
Demonstrates a method which could be used to identify factors which contribute to the radiation exposure to patients from fluoroscopy during contrast examinations of the gastrointestinal tract. Measurements of exposure made at the level of the X-ray tube collimator were extrapolated to obtain entrance exposure at the centre of the field and used as an index of the integral dose to the patient. Such data have heretofore been unavailable. The population studied included 65 patients ranging in age from 1 month to 21 years. The results of an initial study are reported. The authors recommend modifications in the operation and design of fluoroscopic equipment, especially when fitted with brightness and exposure controls, for the reduction of patient exposure. Implementation of two modifications, a high/low dose switch, and a variable aperture iris diaphragm, reduced patient exposure from 1.4 to 3.4 times. (12 refs.)

121010 Occupational exposure in medicine—a review of radiation doses to hospital staff in north-west England. J.S.Hughes, G.C.Roberts (Nat. Radiological Protection Board, Chilton, England), S.K.Stephenson.
Br. J. Radiol. (GB), vol.56, no.670, p.729-35 (Oct. 1983).
The personal monitoring service operated by the Regional Physics Department at the Christie Hospital and Holt Radium Institute, Manchester, monitors staff involved with the uses of ionising radiations at all hospitals and clinics administered by the North Western Region Health Authority in England. Monitoring results relating principally to exposure during 1981 have been collated and examined. The analysis indicates that the doses received by staff are for the most part very low and provide little reason for concern. The only area of work in which worthwhile and cost-effective dose reductions could probably be achieved is that involving the use of pre-loaded applicators in gynaecological intra-cavitary therapy. Some relatively high staff exposures result from the use of this technique, and very significant reductions in these doses are confidently expected from a programme which has now commenced for the increasing use of remotely-controlled afterloading equipment housed in shielded treatment rooms. (7 refs.)

121011 A refinement to a radiation dose reduction modification for an EMI CT 5005 whole body scanner filtration system. K.Cranley, J.A.C.Webb, T.K.Bell (Regional Medical Phys. Service, Royal Victoria Hospital, Belfast, N Ireland).
Br. J. Radiol. (GB), vol.56, no.670, p.770-2 (Oct. 1983).
A modification to the aluminium wedge filtration system of an EMI CT 5005 scanner, providing considerable dose reduction, has recently been reported (Webb et al., ibid., vol.55, p.634-9, 1982). This consists of a pre-patient copper filter and a post-patient dummy wedge as a replacement for the post-patient aluminium wedge which is normally used. A refinement to this system has been developed by considering not only X-rays parallel to the axis of the beam but also those at 5° from the axis, corresponding to the largest angle in the fan beam. This refinement, involving the use of 2 Cu wedge shapes, greatly reduces the over-response of the peripheral detectors. This is achieved without seriously affecting the dose-reduction to the patient or the image quality. (3 refs.)

121012 Collective doses and risks from dental radiology in Great Britain. B.F.Wall, G.M.Kendall (Nat. Radiological Protection Board, Didcot, England).
Br. J. Radiol. (GB), vol.56, no.668, p.511-16 (Aug. 1983).
The continued expansion of dental radiology in Britain up to the end of 1981 is demonstrated, with a rate of increase much in excess of that seen for general medical radiography. Of the total of 7.8×10^6 dental X-ray examinations undertaken in 1981 approximately 6.7×10^6 were intra-oral, 1.5×10^5 were extra-oral and 9.1×10^5 were pantomographic. Weighted dose equivalents for typical examinations in each of these categories were calculated using specific weighting factors for the important 'remainder' organs. Values of 20 μSv, 30 μSv and 80 μSv were obtained for infra-oral, extra-oral and pantomographic techniques, respectively, corresponding to risks of fatal malignancy of 0.33, 0.5 and 1.3 per million. The estimated collective weighted dose equivalent of 212 man Sv to the population of Britain from the current level of dental radiology is predicted to result in no more than about three extra cases of fatal cancer when the age- and sex-related opportunity for manifestation of radiation-induced cancers is taken into account. (11 refs.)

121013 Dose levels outside radiotherapy beams. D.Greene, Gou-Long Chu, D.W.Thomas (Regional Dept. of Medical Phys. & Bioengng., Christie Hospital & Holt Radium Inst., Manchester, England).
Br. J. Radiol. (GB), vol.56, no.668, p.543-50 (Aug. 1983).
The specification of a radiotherapy generator calls for the leakage radiation through the housing of the source to be 0.1% (the ICRP has recently (1982) changed this figure to 0.2% of the dose rate inside the useful beam). When a patient is irradiated, the dose level outside the useful beam is not only determined by this leakage radiation, but also by scattered radiation from the beam-defining system and from the treatment volume of the patient. Measurements have been made on a 300 kV X-ray unit, and on two different 4 MV and one 8 MV linear accelerators to determine the levels of leakage radiation and scattered radiation in air, and in a phantom comparable in size to the trunk of the patient. Similar measurements have also been made for a 15 MeV neutron generator. It is shown that for all these generators the dose delivered outside the radiation beam is determined mainly by the two scattering processes mentioned, and it is argued that for linear accelerators it would be feasible to increase the permitted level of leakage radiation by a factor of 2 or 3 without a significant increase in the stray radiation delivered to the patient. (10 refs.)

121014 Used requirements on CT-based computer dose planning systems in radiation therapy: presentation of 'check lists'. H.Dahlin (Uppsala Datacentral, Uppsala, Sweden), I.-L.Lamm, T.Landberg, S.Levernes, N.Ulso.
Comput. Programs Biomed. (Netherlands), vol.16, no.3, p.131-8 (June 1983).
The expanding use of computers in radiation therapy procedures, especially the rapidly increasing use of digital CT-information, necessitates the coordination of the different systems in order to facilitate their developments. In order to define necessary demands for tomorrow a Nordic cooperation was initiated 1981 by NORDFORSK (Nordic co-operative organization for applied research), and a group of physicians and physicists having their daily work in this field of medicine and physics were invited to produce a report on 'User requirements on CT-based computed dose planning systems in radiation therapy'. The work has been done within the framework of NORDFORSK's activities and has been independent of the existing commissions and associations in the radiology field, but it has taken into consideration recommendations that have been given by or are being produced by other organizations. (11 refs.)

121015 Laser heating of thermoluminescent microdosimeters: prospects in application to imagery by ionizing radiations. J.Gasiot, J.P.Fillard (Lab. de Phys. des Solides III, Univ. des Sci. et Tech. du Languedoc, Montpellier, France), P.Braunlich.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.168-73 (1983). In French. (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
Heating of thermoluminescent materials by pulsed or continuous laser beams is shown to be an attractive means for rapid reading of discrete or continuous two dimensional arrays; applications of this novel laser heating techniques to thermoluminescence imaging of spatial intensity of ionizing radiation with perspectives in X-ray or γ-ray imagery is considered. The thermoluminescence (TL) phenomenon is based on the presence of electron and/or hole traps which, upon exposure to ionizing radiation, become occupied with the respective charge carriers. Thermal energy is provided to replease the trapped carriers. During this process recombination takes place and photons may be emitted until the thermal equilibrium distribution of all carriers is reestablished. The number of luminous photons emitted during the heating period is usually proportional to the ionization irradiation of the material. Experiments have been done with thin layer dosimeters made by powder deposition of CaF_2, $CaSO_4$...on glass sheet. The irradiation was achieved with a Cs 137-γ-source (.66 MeV). A 10 watts CO_2 laser has enabled the layer to be heated at a small point (.5 mm diameter). The interest of such pinpoint heating is obvious; it enables a reading of the absorbed irradiation at this point in a relatively short time ($10\ \text{ms}<t<10^3\ \text{ms}$) and the future prospects in dynamics X-ray image detection to be considered. (9 refs.)

Az egesztestszamlalo scannelo meroelrendezesenek kalibracioja (Whole body counter scanning system calibration) .... See Entry 117702

87.60P Radiation protection

(inc. radiation monitoring)

121016 Effect of plateout, air motion and dust removal on radon decay product concentration in a simulated residence. S.N.Rudnick, W.C.Hinds, E.F.Maher, M.W.First (Dept. of Environmental Health Sci., Harvard Univ. School of Public Health, Boston, MA, USA).
Health Phys. (GB), vol.45, no.2, p.463-70 (Aug. 1983).
The effectiveness of increased air motion and dust removal in reducing radon decay product concentration in residences subject to radon intrusion was evaluated in a 78-m^3 room under steady-state conditions for air infiltration rates between 0.2 and 0.9 air changes per hour. Room-size, portable electrostatic precipitators and high-efficiency fibrous filters were tested as typical residential air cleaning devices; a portable box fan and a ceiling fan were employed as typical residential air movers. Reductions in working levels of 40-90% were found. The fate of radon decay products, with and without mixing fans, was determined by direct measurement. When mixing fans were used, most of the nonairborne potential α-energy was plated out on the room surfaces; less than 10% was deposited on the fan blades or housing. Results were compared to a mathematical model based on well-mixed room air, and good agreement was obtained. (9 refs.)

121017 The effect of electric fields on ^{222}Rn daughter products in indoor air. N.Jonassen (Lab. of Appl. Phys., Tech. Univ. of Denmark, Lyngby, Denmark).
Health Phys. (GB), vol.45, no.2, p.487-91 (Aug. 1983).
A fraction of the short-lived airborne daughter products of ^{222}Rn are charged (positively) and can thus be removed from the air by means of an electric field. A theory is presented which gives the relation between the charged fraction and the total individual daughter activity at equilibrium as a function of the field applied. The theory also allows a deduction of the mobilities of the charged daughter products. Preliminary measurements were performed in a basement room with very low ventilation rate and fairly high radon concentration (5-10 pCi/l.). The electric field was established by applying a voltage to a wire mounted at a height of 1.7 m above the floor and 1 m from the walls. The radon concentration of the air as well as the concentration of the individual ^{222}Rn daughter products were measured at various wire voltages. As an approximation the field was assumed to have a cylindrical configuration. (10 refs.)

121018 Theory and practice of radon monitoring with charcoal adsorption. B.L.Cohen, E.S.Cohen (Dept. of Phys. & Astron., Univ. of Pittsburgh, Pittsburgh, PA, USA).
Health Phys. (GB), vol.45, no.2, p.501-8 (Aug. 1983).
Because of interest in charcoal absorption as an inexpensive radon monitoring technique that may be suitable for mass data collection, the theory of radon adsorption from air by a charcoal bed is developed, giving numerical estimates at all stages. The method is practical down to air concentrations of about 0.1 pCi/l. A simple charcoal bed is limited by the fact that its response is highly sensitive to the time interval before termination of the exposure, but two simple methods of avoiding this problem are developed. Simple methods for determining the diffusion constant for the charcoal being used, and for optimizing the depth of the charcoal bed, are presented. (6 refs.)

121019 Measurement of time-integrated radon concentrations in residences. P.C.Nyberg, D.E.Bernhardt (US Environmental Protection Agency, Las Vegas, NV, USA).
Health Phys. (GB), vol.45, no.2, p.539-43 (Aug. 1983).
Generally it is agreed that time-integrated measurements are preferred over instantaneous measurements for the assessment of chronic health hazards. This is especially true for radon and radon progeny, since their concentrations in air are affected by many things and may easily change by a factor of 10 in a matter of hours. Furthermore, since the greatest radiation dose is delivered by the radon progeny, that average concentration is of the greatest concern. The authors have investigated several integrating monitoring techniques both in the laboratory and in the homes of several volunteers. Of particular interest are the radon progeny integrating sampling units (RPISUs), the passive environmental radon monitors (PERMs), and Track Etch detectors. All of these systems were evaluated in a variety of controlled or semi-controlled environments, and were also deployed in several residences. (6 refs.)

121020 Method for the calculation of radon response characteristics of integrating detectors. S.W.Skinner, P.C.Nyberg (US Environmental Protection Agency, Las Vegas, NV, USA).
Health Phys. (GB), vol.45, no.2, p.544-50 (Aug. 1983).
There has been substantial interest in the use of etched-track detectors for the integrated measurement of radon (^{222}Rn) and its short-lived progeny in the atmosphere of both uranium mines and residences. The methods used for the calculation of the calibration factors have been either a simple average of the factors obtained for all runs, or an average weighted by the number of replicate exposures in each run. While these methods provide a serviceable technique for estimating the radon concentration from the track density, they do not provide a test for the linearity of the data. The authors have

attempted to provide an alternative computational technique which gives a better estimate of the measurement uncertainty, demonstrates the linearity of the correlation and allows the inverse prediction of the radon concentration from a given track density. (5 refs.)

121021 The measurement of low concentrations of radon in air. R.A.Washington, W.J.Courneya (Atomic Energy Control Board, Ottawa, Ontario, Canada).
Health Phys. (GB), vol.45, no.2, p.559-61 (Aug. 1983).
The use of a longterm integrating radon monitor is discussed. The Passive Radon Integrating Monitor (PRIM) is based upon the principle of electrostatic collection of freshly-formed daughters of radon decay. A thermoluminescent dosimeter (TLD) chip is exposed to the alpha and beta particles and gamma rays that are emitted by the daughters upon decay. Its exposure, and thus the radon concentration, is obtained by measuring the thermoluminescence of the chip in a TLD reader. A control chip is used to provide a correction for background radiation levels. The advantages and disadvantages of the PRIM are discussed. The calibration procedures used are described. (12 refs.)

121022 Effects of ionizing radiation and review of the Young-Woollard document. A.M.Marko, D.K.Myers.
Report AECL-8061, Atomic Energy Canada Ltd., Chalk River, Ont. (April 1983), 11 pp.
A review of a document entitled 'The Health Dangers of Uranium Mining and Jurisdictional Questions' has been prepared. E.R. Young and R.F. Woollard submitted, in 1980, this document to the British Columbia Royal Commission of Inquiry, Health and Environmental Protection—Uranium Mining. When the authors reviewed the document it became clear that the views concerning effects of low-level radiation including alpha irradiation do not have scientific consensus. For this reason they have included a brief summary of conclusions produced by various international and national bodies on the effects of radiation on humans. (26 refs.)

A rapid spectroscopic technique for determining the potential α-energy concentration of radon decay products .... See Entry 117723

Radon measurement intercomparisons .... See Entry 117726

The intercalibration of a radon daughter detection system with a radon detection system .... See Entry 117727

The distribution of average radon daughter concentrations in houses estimated from single-sample surveys .... See Entry 121023

The equilibrium factor F (radon daughter concentrations in dwellings) .... See Entry 121024

Verifying a model of radon decay product behavior indoors ..See Entry 121025

Automated system for measuring air-exchange rate and radon concentration in houses .... See Entry 121027

87.60R Radioactive pollution

(see also 86.70 Environmental science)

121023 The distribution of average radon daughter concentrations in houses estimated from single-sample surveys. A.G.Scott (DSMA/ACRES, Toronto, Ontario, Canada).
Health Phys. (GB), vol.45, no.2, p.435-8 (Aug. 1983).
Remedial Action Programs have been established in uranium mining towns because of the high working levels (WL) in some houses. As part of the Remedial Action Program at Elliot Lake, an extensive survey of privately owned property has been carried out. The number of premises with averages above the Remedial Action Level of 20 mWL was found to be less than expected. Given the extensive use of single-sample surveys, the relationship between the distribution of single WL samples taken from a group of houses and the distribution of the annual mean WL of those houses was examined. (4 refs.)

121024 The equilibrium factor F (radon daughter concentrations in dwellings). G.A.Swedjemark (Nat. Inst. of Radiation Protection, Stockholm, Sweden).
Health Phys. (GB), vol.45, no.2, p.453-62 (Aug. 1983).
Consideration of the equilibrium factor F between the concentration of the radon daughters and the concentration of radon is a part of the evaluation of the measurements of radon daughter concentrations in dwellings when applying limits. Measurements of radon, radon daughters and air exchange rates have been carried out in 225 dwellings in Sweden. The F-factors have been compared with the theoretical model described by Wicke (1979), taking into account the wall effect. The parameters of the model are discussed. The situation of the dwelling and the habits of the occupants can be expected to have the greatest importance for the F-factors although the ventilation rate is usually the most important modifying factor. For low air exchange rates ($I<0.30\ hr^{-1}$) the probability that the F-factors were between 0.28 and 0.74 was 95% calculated according to the t-distribution. The arithmetical mean was found to be 0.51. (18 refs.)

121025 Verifying a model of radon decay product behavior indoors. R.C.Bruno (US Environment Protection Agency, Washington, DC, USA).
Health Phys. (GB), vol.45, no.2, p.471-80 (Aug. 1983).
Where it is not feasible to reduce radon levels in houses, exposure to radon decay products may still be reduced through air filtration or other air treatment techniques. A minor modification of a well-known model is used to describe the behavior and fate of radon decay products in the average indoor environment, and to examine the adequacy of the model to predict the impact of a variety of air treatment techniques on indoor radon decay product levels. It is found that the indoor environment is successfully described by the model and that plate-out of radon decay products on surfaces is much less than previous work has suggested. The model also provides a plausible explanation of the effectiveness of a variety of techniques that remove radon decay products from the air. (14 refs.)

121026 Radon daughter deposition velocities estimated from field measurements. A.G.Scott (DSMA/ACRES, Toronto, Ontario, Canada).
Health Phys. (GB), vol.45, no.2, p.481-5 (Aug. 1983).
The surface deposition rate (plateout) of unattached radon daughters was estimated from simple surface activity measurements in a number of occupied buildings, and found to be about one third of the lowest value measured in diffusion tube experiments. This low value was confirmed by surface deposition and activity measurements made in a commercial building with high radon levels, which also showed that the deposition rate was higher on walls than on floors or tables. Predictions of the ratio between airborn and surface-deposited radon daughter activity using the estimated surface deposition rate were close to the ratios observed in occupied homes. Refinements to existing models are required to explain the variability of deposition rate with surface orientation. (5 refs.)

121027 Automated system for measuring air-exchange rate and radon concentration in houses. W.W.Nazaroff, F.J.Offermann, A.W.Robb (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Health Phys. (GB), vol.45, no.2, p.525-37 (Aug. 1983).
An automated system was developed for continuously measuring the air-exchange rate and ^{222}Rn (radon) concentration in an occupied residence. The air-exchange rate is measured over 90-min intervals by tracer gas decay using sulfur hexafluoride as the tracer gas. The radon concentration is measured over 3-hr intervals using a flow-through scintillation cell. Temperatures at up to seven points are measured every half hour. A microcomputer system controls the measurements, performs preliminary data analysis, and logs the data and the results. Continuous measurement of ventilation rate and radon concentration permits the effective radon source magnitude to be calculated as a function of time. The first field application of this system was a study in Rochester, NY, of residential air-exchange rates and indoor air quality. (14 refs.)

A rapid spectroscopic technique for determining the potential α-energy concentration of radon decay products .... See Entry 117723

Radon measurement intercomparisons .... See Entry 117726

The intercalibration of a radon daughter detection system with a radon detection system .... See Entry 117727

Effect of plateout, air motion and dust removal on radon decay product concentration in a simulated residence .... See Entry 121016

The effect of electric fields on ^{222}Rn daughter products in indoor air .... See Entry 121017

Theory and practice of radon monitoring with charcoal adsorption .... See Entry 121018

Measurement of time-integrated radon concentrations in residences .... See Entry 121019

The measurement of low concentrations of radon in air .... See Entry 121021

Effects of ionizing radiation and review of the Young-Woollard document .... See Entry 121022

87.65 AEROSPACE BIOPHYSICS AND MEDICAL PHYSICS (EFFECTS OF ACCELERATIONS, WEIGHTLESSNESS AND ENVIRONMENT)

(see also 94.80 Aerospace facilities and techniques; space research)

121028 Human physiology research under microgravity conditions and the proposed 'Anthrorack' facility. H.Oser (Transportation Systems, ESA, Paris, France).
ESA Bull. (France), no.35, p.40-50 (Aug. 1983).
The European Space Agency's member states have adopted a resolution to carry out a first phase of a Microgravity Research Programme covering the period 1982-5. A proposal for the contents of a second phase is under preparation and will be decided upon in about one year's time. A major element on this second phase is proposed to be the development of a multi-user facility, called 'Anthrorack', to be flown on Spacelab. It would support a wide variety of human physiological investigations on the crew members under conditions of weightlessness. (no refs.)

87.70 BIOMEDICAL ENGINEERING

121029 A computerized mass spectrometer and flowmeter system for respiratory gas measurements. I.E.Sodal, G.D.Swanson, A.J.Micco, F.Sprague, D.G.Ellis (Univ. of Colorado Health Sci. Center, Denver, CO, USA).
Ann. Biomed. Eng. (USA), vol.11, no.2, p.83-99 (1983).
Instrumentation systems for breath-to-breath analysis of respiratory gas exchange have been faulted by phase lags between various flow and composition signals and by difficulties in gathering and processing large amounts of data. The system described here represents an attempt to overcome these problems. Phase delays have been minimized by using a direct, piezoelectrically operated mass spectrometer inlet rather than an inlet capillary, by locating the mass spectrometer inlet and flow sensors in the same plane, and by incorporating design features which enhance the mass spectrometer response. Convenience in system operation and data analysis has been enhanced by integrating a computer into the system design so that the computer performs on-line data analysis and control functions and provides the primary interface between the experimenter and the instruments. Miniaturization of the instruments permits close coupling to an exercising subject. (26 refs.)

121030 Steady-state analysis and evaluation of a new thermal sensor for surface measurements of tissue perfusion. F.S.Castellana, R.Skalak, J.M.Cho, R.B.Case (Dept. of Chem. Engng. & Bioengng. Inst., Columbia Univ., New York, NY, USA).
Ann. Biomed. Eng. (USA), vol.11, no.2, p.101-15 (1983).
The steady-state response and operating characteristics of a new thermal sensor for surface measurements of local tissue perfusion have been analyzed theoretically and evaluated in vivo. The flow measurement system incorporates an electrically isolated thin-film thermal sensor, which is maintained at a fixed temperature by high frequency response electronic circuitry. The sensor rests on the tissue surface, and the power required to maintain a fixed probe to tissue temperature elevation is measured and related to tissue blood flow. A theoretical analysis of the steady-state probe response to flow changes was carried out employing the bio-heat-transfer equation and a solution based on Fourier series to describe the temperature distribution within the tissue domain. A comparison of steady-state theory to results obtained from initial experimental tests on the surface of the dog heart, over a perfusion range 0.51 to 2.00 ml/min/g, shows close agreement. The probe demonstrates good sensitivity to flow changes, provides stable and continuous measurements, and appears promising for both research and clinical applications. (14 refs.)

121031 An improved method for water vapor detection. T.Adams, M.A.Steinmetz (Dept. of Physiology, Michigan State Univ., East Lansing, MI, USA), D.B.Manner, D.M.Baldwin, S.R.Heisey.
Ann. Biomed. Eng. (USA), vol.11, no.2, p.117-29 (1983).
Describes improvements in and details for the construction, calibration and use of a device using a thermal conductivity cell for the measurement of low-level rates of water evaporation (E) from a small surface area. E is measured from 0.0 to 1.0 $mg.min^{-1}$ with a correlation coefficient of 0.999 between measured and independently verified rates and amounts of water evaporation. Data are available as a recordable analog DC voltage as well as in digital display for E and for the amount of water evaporated during an operator defined time period. The device describes is noninvasive and it is designed to be constructed of conventional components. It is useful not only for measuring transcutaneous water diffusion in normal and diseased skin but also it is adequately sensitive and rapidly responding to follow thermoregulat-

ory and psychogenic sweating in small (nom. 1.0 cm^2) skin areas. It can also be used to measure accurately and precisely the rates at which water is adsorbed by and removed from inanimate materials, as well as to determine how much water they store. (19 refs.)

121032 Which parameters of circulation can be made visible by electronic oscillography? III. M.Prag (Univ. Erlangen, Nurnberg, Germany).
Acta Medicotech. (Germany), vol.30, no.6, p.216-18 (Dec. 1982). In German.
For pt.II see ibid., vol.30, no.4, p.142, 1982. Blood pressure measurements on the lower arm constantly show a difference between peak measurements taken with rising pressure and those with falling pressure. This could be due to a systematic error, and which type of measurement is the more accurate cannot be determined. To avoid error due to a stagnation effect in the veins and capillaries cut off by the first measurement, adequate recovery time should be allowed between the two measurements. While it is desirable that the sleeves should always be pulled really tight, it is found that the tighter the fit, the larger are the amplitudes recorded. There are two possible explanations. The first, due to Sturm, is that a rounded sleeve compresses a smaller section of artery than one which lies flat, so that the volume change is smaller. The second is that an equally large volume variation is set against a greater basic volume in the sleeve, so that it is smaller in proportion and hence smaller amplitudes are plotted. (no refs.) *D.J.B.*

121033 Accuracy of computer measurements of QRS duration using spatial magnitude—agreement with human readers. G.E.Dower (Polarcardiography Lab., Shaughnessy Hospital, Vancouver, British Columbia, Canada), D.Berghofer, M.Kiely.
Comput. & Biomed. Res. (USA), vol.16, no.5, p.433-45 (Oct. 1983).
The beginning and end of the QRS complex in the ECG are often poorly defined, leading to poor agreement between measurements of QRS duration made by computer and human readers. In the spatial magnitude tracing, on the other hand, definition of QRS onset and offset points is less ambiguous. In 50 normal subjects, 345 QRS durations were measured by computer and visually. The correlation coefficient between the two methods was 0.93; the typical discrepancy was less than 3 msec. For a series of 100 inpatients, similar results were obtained even though one of the human readers was unfamiliar with the spatial magnitude display. Although the spatial magnitude is obtained from vectorcardiographic xyz signals, it could be derived from three simultaneous ECG leads, and applied to computer programs analyzing the 12-lead ECG. (16 refs.)

121034 Detection of muscle tremors and baseline sway in an ECG. R.E.Bonner (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.3A, p.1109-10 (Aug. 1983).
A method is described for processing an electrocardiagram (ECG) waveform to detect the presence of 'noise' caused by muscle tremors or baseline sway. (no refs.)

121035 Medical applications of silicon sensors. J.M.L.Engels, M.H.Kuypers (Honeywell & Philips Medical Electronics BV, Best, Netherlands).
J. Phys. E (GB), vol.16, no.10, p.987-94 (Oct. 1983).
For invasive medical sensors, silicon sensors have a number of specific advantages: miniaturisation, low cost, high flexibility, high reliability, choice of parameter, packaging and integration of electronics. Specific packaging problems for microtransducer catheters (MTCS) whereby the transducer is a silicon sensor are related to the construction of the transducer housing and choice of materials. The main object is to maintain the sensitivity of the silicon sensor for the specific parameter while designing a proper housing. This is illustrated by describing solutions for pressure- and oxygen-sensitive MTCSs. Two sets of factors which promote the use of MTCS in hospitals are discussed. The first is the quality of signal and the possibility of continuous monitoring of the measured parameter. The second comprises patient comfort, simpler application techniques and economic factors. (41 refs.)

121036 Noninvasive measurement of pleural pressure by surface inductive plethysmography. M.J.Tobin, G.A.Jenouri, H.Watson, M.A.Sackner (Dept. of Medicine, Mount Sinai Medical Center, Miami Beach, FL, USA).
J. Appl. Physiol. (USA), vol.55, no.1, p.267-75 (July 1983).
Recession of the suprasternal fossa that takes place during inspiration can be monitored with surface inductive plethysmography (SIP). The transducer consists of a flat loop of Teflon-insulated wire coupled to the skin. Static lung compliance during inflation was obtained using a 'null procedure' (described) in six normal subjects and eight patients with lung disease, and both SIP and esophageal pressure gave similar values. Dynamic lung compliance was calculated at respiratory rates from 20 to 60 breaths/min; simultaneous SIP and esophageal balloon values in seven normal subjects and seven patients with lung disease showed close correlation. Frequency dependence of compliance was demonstrated in a group of smokers with small airway disease whereas compliance was not frequency dependent in normals. Surface inductive plethysmography appears to be a reliable noninvasive alternative to intraesophageal pressure recordings to obtain static and dynamic lung compliance. (20 refs.)

121037 Noninvasive ventilatory monitoring with bellows pneumographs in supine subjects. D.R.Morel, A.Forster, P.M.Suter (Dept. of Anesthesia, Univ. of Geneva, Geneva, Switzerland).
J. Appl. Physiol. (USA), vol.55, no.2, p.598-606 (Aug. 1983).
The authors compared simultaneous measurements of ventilatory movements obtained by a bellows pneumograph (BP) and a respiratory inductive plethysmograph (RIP) vs. integrated volume from a pneumotachograph in seven healthy volunteers during different respiratory patterns. The purpose of this study was to assess if a computer-aided calibration procedure could improve the accuracy of BP, a simple semiquantitative method for noninvasive ventilatory monitoring in supine subjects. Both devices were repeatedly calibrated against a pneumotachograph in the same posture with a computer-aided least-squares method. One calibration maneuver was sufficient to achieve a minimal relative difference in volume measurements between the RIP as well as the BP and the pneumotachograph of less than 1.2 ± 4.5 (SD) %. The accuracy remained in this range during the subsequent calibrations with time (1 h) and after body movements. However, this difference increased significantly with both devices when the subjects were studied in the lateral decubitus position. The present study indicates that despite theoretical advantages of the RIP, the BP, when properly calibrated, has similar performances in supine subjects for monitoring ventilation; it is simpler and less expensive than the RIP and is devoid of electrical drift and artifacts. (15 refs.)

121038 Ergometric evaluation of pathological gait. G.A.Cavagna, L.Tesio, T.Fuchimoto, N.C.Heglund (Istituto di Fisiologia Umana, Univ. di Milano, Milan, Italy).
J. Appl. Physiol. (USA), vol.55, no.2, p.607-13 (Aug. 1983).
At each step of walking, the center of gravity of the body moves up and down and accelerates and decelerates forward with a combined movement that allows an appreciable transfer (R) between gravitational potential emergy, and kinetic energy, as occurs in a pendulum. The positive work and power to lift the center of gravity, to accelerate it forward, and to maintain its motion in a sagittal plane, the amount of R, the maximal height reached during each step by the center of gravity, and the step length and frequency may all be determined by a microcomputer a few minutes after a subject walks on a force platform. This method was applied to the analysis of pathological gait in the attempt to measure quantitatively the alteration of the normal locomotory movement of the center of gravity. The strides of the patient were compared with the strides of normal subjects; in addition, the movement of the center of gravity of the patient during the stance on the affected limb was compared with the movement of the center of gravity during the stance on the unaffected limb, thus giving an index of the asymmetry of locomotion. (7 refs.)

121039 Subtraction of electrocardiographic signal from respiratory electromyogram. R.Bloch (McMaster Medical School, Chedoke Rehabilitation Hospital, Hamilton, Ontario, Canada).
J. Appl. Physiol. (USA), vol.55, no.2, p.619-23 (Aug. 1983).
A method is presented to selectively suppress interfering electrocardiographic artifacts from the surface-recorded respiratory muscle electromyographic (EMG) signal. This method has application in the frequency analysis of respiratory muscle EMG. (7 refs.)

121040 Using body surface movements to study breathing. H.R.Gribbin (Dept. of Medicine, Univ. Coll. Hospital, London, England).
J. Med. Eng. & Technol. (GB), vol.7, no.5, p.217-23 (Sept.-Oct. 1983).
The chest wall comprising both rib cage and abdomen moves during breathing, and when suitably calibrated this motion can be used to monitor pulmonary ventilation without the need for face-masks or mouthpieces. Such noninvasive methods of studying breathing are likely to become more widely used in the future, especially in the investigation of respiratory control and sleep-disordered breathing. This review describes the physiological basis of these measurements and examines the practical and theoretical limitations of calibration techniques based on the two degrees-of-freedom model of chest-wall motion. (14 refs.)

121041 An optimal linear filter for the reduction of noise superimposed to the EEG signal. F.Bartoli, S.Cerutti (Dipartimento di Elettronica, Politecnico di Milano, Milan, Italy).
J. Biomed. Eng. (GB), vol.5, no.4, p.274-80 (Oct. 1983).
A procedure for the reduction of super-imposed noise on EEG tracings is described, which makes use of linear digital filtering and identification methods. In particular, an optimal filter (a Kalman filter) has been developed which is intended to capture the disturbances of the electromyographic noise on the basis of an a priori modelling which considers a series of impulses with a temporal occurrence according to a Poisson distribution as a noise generating mechanism. The experimental results presented refer to the EEG tracings recorded from 20 patients in normal resting conditions: the procedure consists of a pre-processing phase (which uses also a low-pass FIR digital filter), followed by the implementation of the identification and the Kalman filter. The performance of the filters is satisfactory also from the clinical standpoint, obtaining a marked reduction of noise without distorting the useful information contained in the signal. (26 refs.)

121042 A gait analysis system in clinical practice. G.Gifford, J.Hughes (Northwick Park Hospital, Harrow, England).
J. Biomed. Eng. (GB), vol.5, no.4, p.297-301 (Oct. 1983).
A gait analysis system using a transduced walkway, monitored by microcomputer to measure the time and distance factors of gait, has been in regular clinical use for over two and a half years. The results are easy to understand and have provided objective data which has been found useful in a number of clinical situations. Some of the ways in which the system has been used are described. (2 refs.)

121043 Recent topics in medical measurements. F.Kajiya, Y.Ogasawara, K.Mito, S.Tadaoka, M.Nakai, O.Hiramatsu, G.Tomonaga, N.Hohki.
Syst. & Control (Japan), vol.27, no.3, p.169-77 (March 1983). In Japanese.
Bioinstrumentation in the direct measurement of biological properties can be divided into two large categories: (1) the measurement of energies produced in living organisms themselves, e.g. pressure changes, volume changes, vibratory action, potentials and heat; and (2) the observation of response to applied energy such as X-rays, ultrasonic waves, magnetic fields, radioisotopes, heat, or laser beams. The fundamental biological parameters in the bioinstrumentation of the circulatory system are heart features, blood flow and blood pressure. A brief outline is given of ultrasonic-echo imaging, X-ray imaging, positron CT imaging and NMR imaging techniques in heart dimensions instrumentation, of heart catheterization for blood pressure instrumentation and of the ultrasonic pulse doppler method and the laser doppler method for blood flow instrumentation. (15 refs.) *K.B.*

121044 A programmable limb testing system (and some measurements of intrinsic muscular and reflex-mediated stiffnesses). C.Billian, G.I.Zahalak (Dept. of Mech. Engng., Washington Univ., St. Louis, MO, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.6-11 (Feb. 1983). [received: Oct. 1983]
A new versatile apparatus for investigating the neuromusculoskeletal dynamics of the upper limb, termed the Programmable Limb Testing System (PLTS) has been designed, built, and tested. The planning, construction, and operation of this system are described in this paper. Results are presented from a limited set of experiments, measuring intrinsic muscular and reflex-mediated stiffnesses of the triceps brachii, which exhibit the system's performance and some of its capabilities. (16 refs.)

121045 Error analysis of a system for measuring three-dimensional joint motion. W.J.Suntay, E.S.Grood, M.S.Hefzy, D.L.Butler, F.R.Noyes (Dept. of Orthopaedic Surgery, Univ. of Cincinnati, OH, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.127-35 (May 1983). [received: Oct. 1983]
In the past ten years there has been increased use of six-degree-of-freedom instrumented spatial linkages for the measurement of biological joint motions. In spite of the increased popularity, little information has been reported on the accuracy of these devices. In this paper, the authors present a two-part investigation of the accuracy of the instrumented spatial linkage when used to measure knee joint kinematics. In the first part, they present the results of a theoretical analysis and an experimental determination of the errors associated with spatial linkage systems. In the second part, they describe the errors associated with a bi-planar X-ray system used to obtain the coordinate transformation between the linkage ends and coordinate systems located in the bones comprising the joint. The authors found that the theoretical error analysis consistently overestimated the actual measurement error, thus providing an unreliable estimate of errors. The experimental study of both the linkage system and the bi-planar X-ray system demonstrated that the accuracy of displacement measurement is insensitive to large systematic errors in position measurement. (31 refs.)

121046 A preliminary use of ferrography in the study of arthritic diseases. G.H.Mills (Dept. of Metall., Brunel Univ., Uxbridge, England), J.A.Hunter.
Wear (Switzerland), vol.90, no.1, p.107-11 (15 Sept. 1983). (First International Conference on Advances in Ferrography, Swansea, Wales, 22-24 Sept. 1982).
Ferrography applied as a failure analysis or condition monitoring technique to engineering components has proved successful over the past decade. As human joints are similar to some lubricated engineering components it is natural to consider the application of ferrography to the examination of 'wear particles' in synovial fluid obtained from human joints. An attempt to compare the number and type of wear particles with the extent of damage to articular surfaces has been undertaken with some limited success. (5 refs.)

121047 A user's look at technology for hospitals. D.Harrington (New England Medical Center, Boston, MA, USA).
Electro/82 Conference Record, Boston, MA, USA, 25-27 May 1982 (El Segundo, CA, USA: Electron. Conventions 1982), p.15-3/1-5
Looks at the technology presently in hospitals, discussing some common problems and offering suggestions for future designs, especially for use by nurses. (no refs.)

Simultaneous quantitation of knee ligament forces .... See Entry 120902

A joint coordinate system for the clinical description of three-dimensional motions: application to the knee .... See Entry 120939

Noninvasive method for detecting laryngeal narrowing with low-frequency sound .... See Entry 120968

High speed tympanometry and ipsilateral middle ear reflex measurements using a computerised impedance meter .... See Entry 120970

Comparison of manual and computer-controlled audiometry using identical procedures .... See Entry 120971

The selection of modulation rates for frequency modulated sound field stimuli .... See Entry 120972

Double pulsed holographic interferometry on human beings in vivo .... See Entry 120978

Non-invasive microwave monitoring of respiratory pattern .... See Entry 120979

Nuclear magnetic resonance blood flow measurements in the human brain .... See Entry 120981

87.70E Diagnostic methods and instrumentation

(see also 87.60 Medical and biomedical uses of fields, radiations and radioactivity)

121048 Rational gain compensation for attenuation in cardiac ultrasonography. H.E.Melton,Jr. (Depts. of Electrical & Computer Engng. & Internal Medicine, Univ. of Iowa, Iowa City, IA, USA), D.J.Skorton.
Ultrason. Imaging (USA), vol.5, no.3, p.214-28 (July 1983).
A new method of compensating for the attenuation of ultrasound by chest wall, myocardium and blood has been devised by using an optimum threshold to distinguish between blood and myocardium. This allows changing receiver gain at rates suitable for either blood or myocardium for each line-of-sight forming a real-time image. Compensation artifacts arising from the effects of speckle or phase cancellation are minimized by using a one-bit digital filter after threshold detection. This method of compensation is a necessary first step toward quantitative two-dimensional echocardiography. (12 refs.)

Conception and realization of a photoacoustic detector for in situ spectroscopy .... See Entry 117248

Applications of 3-D nuclear scattering radiography in technology and medicine .... See Entry 120520

The geometric and Fourier transform solutions for the object-image conjugated interference field of human retina in the visual acuity examination by laser interferometry .... See Entry 120842

Laser speckle technique for the visualization of retinal blood flow .... See Entry 120849

Recent trends of medical image processing .... See Entry 120966

Present status of medical imaging apparatus .... See Entry 120967

Real time ultrasonic imaging with arrays .... See Entry 120974

A new magnetic method for studying the quality of lung-retained dust in vivo .... See Entry 120975

Diagnostic potential of magneto-photoacoustic spectroscopy .... See Entry 120976

Eye deformation measurement by laser interferometry .... See Entry 120977

Nuclear magnetic resonance imaging: an overview .... See Entry 120982

A microscope-television system for online measurement of blood flow velocity in microvessel using an adaptive window .... See Entry 120983

Medical diagnosis and imaging using electromagnetic techniques .... See Entry 120984

Computer-aided tomography in the determination of lung density in irradiation planning .... See Entry 120986

Radionuclide studies on ventilation and perfusion in different lung regions .... See Entry 120987

A phantom to assess quantitative recovery of positron tomographs .... See Entry 120988

Artifact simulating chronic extracerebral fluid collections on computed tomography of the head .... See Entry 120989

Tungsten anode tubes with K-edge filters for mammography .... See Entry 120990

Preliminary clinical images from a prototype positron camera .... See Entry 120991

Real time digital intravenous angiography .... See Entry 120992

Acquisition of organ slice images in nuclear medicine by the multiple-incidence technique .... See Entry 120993

Numerical method of 'adapted' deconvolution: application to the tomography by coded aperture .... See Entry 120994

Computer generated 3-D display of X-ray computed tomographic volume image data .... See Entry 120995

Attainment of 3-D images in nuclear medicine by coded-aperture devices .... See Entry 120996

Study of methods of 3-D reconstruction in radiography .... See Entry 120997

Study of optimal reconstruction techniques in the field of X-ray tomodensitometry of the heart .... See Entry 120998

Radiation risk of thyroid scintigraphy in newborns .... See Entry 120999

A method of quantitative ^{67}Ga scintigraphy in the evaluation of pulmonary sarcoidosis .... See Entry 121000

Quantitative, non-invasive cerebral blood flood flow measurements with non-diffusible tracers using a heart-rate-dependent recirculation correction—application in carotid surgery .... See Entry 121001

Comparative CT examination of the anterior crucial ligament in direct projection and by means of sagittal reconstruction .... See Entry 121002

Standardization of ^{18}F for use in positron-emission tomography .... See Entry 121003

Large format X-ray image intensifier for lung investigations .... See Entry 121005

Gastrointestinal fluoroscopy: patient dose and methods for its reduction .... See Entry 121009

A refinement to a radiation dose reduction modification for an EMI CT 5005 whole body scanner filtration system .... See Entry 121011

87.70G Patient care and treatment

121049 Development of a cryoprobe suitable for gynaecological applications. N.Girishchandra Shah (Dept. of Obstetrics & Gynaecology, Sheth KM School of Post Graduate Medicine & Res., Ahmedabad, India), V.M.Mehta, G.Harilal Shah.
Indian J. Cryog., vol.8, no.2, p.116-20 (1983).
Cryosurgery, meaning clinically controlled application of destructive effects of freezing, is painless, achieves haemostasis and destroys the tissue with a sharp line of demarcation. It can be used as an O.PD. procedure because of its simplicity and painlessness. Cryosurgery has never gained momentum in India because of the price of the instrument required. A project to develop a cheap and dependable cryo-probe was undertaken so that the cryo-probe becomes a useful tool in the day-to-day practice of each and every gynaecologist. The Joule-Thomson effect was utilized to design a cheap and dependable cryo-probe working on commonly available liquid gases like carbon dioxide, freon and nitrous oxide. (no refs.)

Laser 83 Opto-Elektronik. 6th International Congress and International Trade Fair (papers in summary form only received) .... See Entry 116929

The RBE of the leakage radiation from the Hiletron neutron therapy unit .... See Entry 120947

Sounding the heart. A new acoustic therapy .... See Entry 120969

A variable pulse-burst electromagnetic generator for electrical stimulation of biological systems .... See Entry 120980

Medical therapy with π^- mesons .... See Entry 120985

Computer-aided tomography in the determination of lung density in irradiation planning .... See Entry 120986

A conceptual design of neutron tumor therapy reactor facility with a YAYOI based fast neutron source reactor .... See Entry 121004

Pions against cancer. New tumour therapy at UBC .... See Entry 121006

Dosimetric characteristics of ^{125}I encapsulated sources for interstitial radiation therapy .... See Entry 121008

Dose levels outside radiotherapy beams .... See Entry 121013

Used requirements on CT-based computer dose planning systems in radiation therapy: presentation of 'check lists' .... See Entry 121014

Laser heating of thermoluminescent microdosimeters: prospects in application to imagery by ionizing radiations .... See Entry 121015

87.70J Prosthetics and other practical applications

121050 Heart pacemakers: Australian success story. P.Watson.
Electron. Aust. (Australia), vol.45, no.6, p.32-9 (June 1983).
Discusses the development of pacemakers in Australia. Describes the modern programmable pacemaker in which a whole range of operating parameters can be changed, and set up in any combination, by means of an external program unit. The pulses are magnetic, generated by a large and powerful electromagnet in an external programmer. They are sensed in the pacemaker by means of a tiny reed switch, the glass of which is a mere 6 mm long and about 1 mm diameter. As well as the electromagnet, the programmer contains all encoding circuitry, switches, indicators, etc. In use, it is simply placed over the implantation site. (no refs.)

121051 Speech signal presentation to the totally deaf. J.R.Walliker (Dept. of Phonetics & Linguistics, Univ. Coll. London, London, England), S.Rosen, E.E.Douek, A.J.Fourcin, B.C.J.Moore.
J. Biomed. Eng. (GB), vol.5, no.4, p.316-20 (Oct. 1983).
Describes a system for single-channel electrical stimulation of the totally deaf. The patient wears a removable electrode assembly which stimulates the cochlear promontory and can be inserted and removed like the earmould of a hearing aid. This approach minimises therisk of mechanical or electrochemical damage to structures within the cochlea. Charge-balanced stimulation is used to present those speech pattern elements that are matched to the patients' lipreading needs and their new sensory abilities. Objective tests show improvements both in patients' perceptive and productive abilities. (13 refs.)

121052 Microprocessor-controlled driving unit for artificial hearts. N.Nessler (Inst. for Experimental Phys., Innsbruck Univ., Innsbruck, Austria).
Microprocess. & Microsyst. (GB), vol.7, no.7, p.306-13 (Sept. 1983).
Heart failure and cardiac infarction are the main causes of death today. The author describes a driving unit for artificial hearts which uses an electromagnet as a power source and has hydraulic transmission to the artificial ventricle. (8 refs.)

121053 Stresses in a Harrington distraction rod: their origin and relationship to fatigue fractures in vivo. J.B.Brunski, D.C.Hill (Dept. of Biomedical Engng., Rensselaer Polytech. Inst., Troy, NY, USA), A.Moskowitz.
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.101-7 (May 1983). [received: Oct. 1983]
As illustrated by the case study described in this paper, in-vivo fractures of distraction rods often occur by metallurgic fatigue at the junction between the smooth and ratcheted parts of the rod (i.e. at the first ratchet junction, FRJ). To clarify causative factors of fatigue at the FRJ, stresses are analyzed in a standard 11-in. rod using both experimental and theoretical methods. The analyses reveal how distraction force, eccentricity of loading, rod geometry and material determine the stresses at the FRJ. These stresses can exceed the fatigue endurance limit for certain clinically encountered conditions. (27 refs.)

121054 Monitoring fracture site properties with external fixation. G.S.Beaupre, W.C.Hayes, M.H.Jofe, A.A.White,III (Charles A. Dana Res. Inst., Beth Israel Hospital, Boston, MA, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.2, p.120-6 (May 1983). [received: Oct. 1983]
An in-vitro system has been devised to monitor the properties of an idealized fracture site immobilized with a Hoffman-Vidal external fixator. A dial gage was used to measure the relative pin displacements under controlled axial loading. The displacement measurements were then used in conjunction with a finite element model to predict the modulus of an idealized fracture site. Five fracture sites made of neoprene disks of different mechanical properties were monitored in order to simulate the increasing modulus of a healing fracture. Good agreement was observed between directly measured mechanical properties of the neoprene and those inferred from the combined finite element and pin displacement tests. (18 refs.)

121055 The difference between a communication aid and a speech prosthesis. B.R.Baker (BCS Corp., Cumberland, MD, USA).
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.756-61 vol.2
Many devices developed in the past decade are aiding severly disabled people to communicate. Yet this new technology often remains beyond the physical or intellectual capabilities of the majority of possible users. A new generation of communication systems is needed. A clarification of terminology can be instrumental in facilitating the development and distribution of these new systems. (no refs.)

121056 Design of a pulse duplicator system for prosthetic heart valves. M.Umezu, K.Kawazoe, N.Fujii, T.Fujita, T.Akutsu (Nat. Cardiovascular Center Res. Inst., Osaka, Japan).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.751-8
In order to obtain a useful information when selecting a prosthetic heart valve in each patient with valvular disease, the authors have developed an in-vitro test apparatus for the evaluation of the characteristics of various valves. It consists of a pneumatically driven pulsatile pump, natural rubber tubes, compliance regulating tanks and needle valves. The system was designed so that the flow dynamics would show close resemblance to human haemodynamics in the normal state as well as in the heart failure. Commercially available valves (seven mechanical valves and six biological valves) were tested. In the inlet (mitral) position, the inflow resistance across porcine valves and a ball valve were higher than those across disc valves and bovine pericardial valves. In the outlet (aortic) position, pump output and pressure gradient across the valves were similar in all valves except for the ball valve. On the basis of the simulation data, the bovine pericardial valve and one of the tilting disc valves were found to be the most suitable valves for clinical use. (2 refs.)

121057 Development of an electromyogram (EMG) controlled above-knee prosthesis using microcomputer. J.Cheng (Dept. of Electrical Engng. & Computer Sci., Shanghai Jiao Tong Univ., Shanghai, China), K.Koganezawa, I.Kato.
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.865-72
Deals with the schemes which solved the two problems of an above-knee prosthesis during the swing phase. The first problem is to adjust continuously the damping performance of the knee-joint according to the walking period of the next step predicted from the myoelectric signal. The second problem is to generate the driving torque to eliminate the swing delay of the prosthetic shank. The authors have developed a new type of WLP-5 above-knee prosthesis with the above-mentioned functions and its portable control unit with the microcomputer. The clinical walking experiment of an above-knee amputee has been performed using the WLP-5 system. From the results, the effectiveness of the WLP-5 system has been ascertained. (3 refs.)

Instantaneous voice period measurement for cochlear stimulation .... See Entry 118331

Impact of recruitment order on electrode design for neural prosthetics of skeletal muscle .... See Entry 120824

The effects of contact lens deformation on tear film pressure and thickness during motion of the lens towards the eye .... See Entry 120840

Electrogoniometry of post-surgical knee bracing in running .. See Entry 120874

An estimate of the stress-field in an osseous medium having a no-slip interface crack .... See Entry 120878

Finite-element-analysis and experimental investigation in a femur with hip endoprosthesis .... See Entry 120918

87.80 BIOPHYSICAL INSTRUMENTATION AND TECHNIQUES

121058 Determination of the thickness of inhomogeneous membrane by the optical method. V.I.Pasechnik (Phys. Faculty, Lomonosov State Univ., Moscow, USSR).
Biophysics (GB), vol.27, no.5, p.960-2 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.5, p.914-15 (1982). [received: Sept. 1983]
A method has been devised for determining the thickness of a bilayer which allows for the inhomogeneity of the membrane. The method is based on the reflective capacity of the membrane. (7 refs.)

121059 A computer system for real-time data acquisition and analysis of biopotentials and quantal content at the neuromuscular junction. H.H.Liu, Y.I.Kim (Dept. of Biomedical Engng. & Neurology, Univ. of Virginia School of Medicine, Charlottesville, VA, USA).
Comput. Programs Biomed. (Netherlands), vol.16, no.3, p.161-74 (June 1983).
A computerized data acquisition system for online analysis of the parameters of neuromuscular transmission is described. Both hardware usage and software methodologies are discussed with regard to sampling in real-time and analyzing miniature end-plate potentials (MEPPs), end-plate potentials (EPPs) and quantal content of the evoked transmitter release. Significant features of the program include: (1) automatic threshold determination for MEPP detection; (2) the use of a circular buffer to give pre-trigger information; (3) real-time noise spike rejection; (4) an automatic procedure for EPP failure detection; (5) rapid quantal content determinations by several methods as well as complete MEPP and EPP waveform analysis. The system has proven both accurate and reliable during more than two years of use. Advantages of the system over conventional methods include: (1) increased accuracy and efficiency in data analysis; (2) immediate availability of results; (3) convenient data storage; (4) flexibility to meet changing requirements. (21 refs.)

121060 Automated analysis of neuromuscular 'jitter'. L.Antoni, E.Stalberg (Dept. of Clinical Neurophysiology & Medical Engng., Univ. Hospital, Uppsala, Sweden), D.Sanders.
Comput. Programs Biomed. (Netherlands), vol.16, no.3, p.175-88 (June 1983).
This article describes an interactive program for real time analysis of the neuromuscular jitter. Two implementations, using different hardware for data acquisition, reflect the modular design and flexibility of the software. Details on the time windows are given as well as the available commands. The program features: (1) immediate feedback of acquired data; (2) optional manual editing of data; (3) simple yet flexible commands; (4) several plot options of raw or analysed data; (5) database interface. (13 refs.)

121061 A new method for automatic metaphase finding adaptable to different chromosome preparations. D.Schoevaert-Brossault, C.Leonard, J.Selva (Lab. d'Histologie-Embryologie-Cytogenetique, Hopital de Bicetre, Kremlin Bicetre, France).
Comput. Programs Biomed. (Netherlands), vol.16, no.3, p.195-202 (June 1983).
A FORTRAN computer program, running on a Digital PDP 11-34 minicomputer, has been developed for use in conjunction with a Cambridge Quantimet 720 image analyzer for the investigation of metaphase preparations in routine cytogenetics. During a short initiation phase the program is adapted to the type of metaphase being analyzed. The program is fast and its performance is good, even at low microscopic magnifications. It has other uses in biology for all investigations and characterizations of groups of small distinct elements widely spread within a preparation (e.g. autoradiography, bacteriology). (9 refs.)

121062 High-speed cineradiographic system for biomechanics impact research. M.Bender, N.Alem, G.Nusholtz, J.W.Melvin (Highway Safety Res. Inst., Univ. of Michigan, Ann Arbor, MI, USA), W.L.Rogers.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.312, p.130-5 (1983). (1st European Conference on Cineradiography with Photons or Particles, Paris, France, 18-21 May 1981).
A high-speed 16-mm cineradiographic system previously developed for use in biosciences research has been upgraded in capability by (1) increasing the X-ray field to 35-cm (14-in) by 43-cm (17-in), (2) incorporating a 35-mm high-speed motion picture to increase resolution, and (3) acquisition of a second X-ray head for three-dimensional X-ray stereophotogrammetric studies. This system now consists of a 35-mm Photosonics 4B camera, capable of 2500 frames per second, which views a 50-mm (2-in) diameter output phosphor of a highgain, 4-stage, magnetically focused image intensifier tube, gated on and off synchronously with the motion picture camera. A lens optically couples the input photocathode of the image tube to X-ray fluorescent (rare earth) screen images produced by a smoothed DC X-ray generator of a conventional type. The system is capable of a wide range of magnification ratios. (5 refs.)

121063 Recent advances in laser fluorescence microscopy. F.Docchio, A.Longoni, R.Ramponi, C.A.Sacchi (Centro di Studio per l'Elettronica Quantistica e la Strumentazione Elettronica, Istituto di Fisica del Politecnico, Milano, Italy), G.Bottiroli, I.Freitas.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.16-21 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
First, the authors present the latest version of a laser microfluorometer, characterized by high spatial and temporal resolution, and by a high degree of versatility and automation due to microprocessor control. The authors also present the latest results in the application of this technique to the study of the interaction properties of the photosensitizing antitumor drug Hematoporphyrin Derivative (HpD) at cellular level. (16 refs.)

121064 Inexpensive laser Doppler instrument for cell electrophoresis. D.G.Spendley, D.P.Jones, A.T.Smith, D.S.L.Lloyd, E.D.Cooke (Dept. of Medical Electronics, St. Bartholomew's Hospital, London, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.174-7 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A laser Doppler electrophoresis system for the measurement of cell mobilities in hospital laboratories has been developed. Standard inexpensive optical components are used together with a 2 mW HeNe laser and a photodiode detector. An equal path length fringe mode system is used. No elaborate antivibration precautions have been found necessary. The electrophoretic measurement cell is robust and simple. Data are collected and analyzed by an existing Nova 3D minicomputer utilizing standard software used routinely for electrophysiological signal processing. Mobility spectra are presented from various human and animal blood cells and from a tissue culture cell line. (5 refs.)

121065 Measurement of displacements introduced by extra-oral orthodontic forces on a macerated skull by means of speckle interferometry: a preliminary report. J.Kleutghen, L.R.Dermaut, P.M.Boone, M.De Caluwe (Dept. of Orthodontics, State Univ. Gent, Gent, Belgium).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.538-50 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A technique was developed for measuring tooth displacements, caused by extraoral orthodontic forces. By using speckle-interferometry as the measurement technique and a macerated dry human skull as test object, a reliable investigation procedure is developed. Resolution of total displacement into vector components is realized by simple trigonometry. These observations showed to be very interesting for the biomechanics of clinical headgear Forces. for the purpose of orthodontic research, speckle interferometry was applied and is expected to be a promising technique. (13 refs.)

121066 A constant-velocity cycle ergometer for the study of dynamic muscle function. N.McCartney, G.J.F.Heigenhauser, A.J.Sargeant, N.L.Jones (Dept. of Medicine, McMaster Univ. Health Sci. Centre, Hamilton, Ontario, Canada).
J. Appl. Physiol. (USA), vol.55, no.1, p.212-17 (July 1983).
A cycle ergometer has been designed to measure the force exerted on the pedal cranks during maximum effort at a variety of constant velocities. Preset crank velocities of 13-166 rpm are established by a controlled 3-hp motor and cannot be overcome by the subject. Torque is measured by strain gauges bonded to the crank shafts; peak torque, peak power, work, and average power are derived for each pedal cycle. Studies in 30 healthy male subjects established reproducibility and normal standards. During exercise for 45 s at a constant velocity of 60 rpm, there was a wide intersubject variation in both maximal torque (118-226 N.m) and the percentage decline in torque (27.2-52.0%). The decline in torque was inversely related to maximal O_2 intake ($r=0.84$). During short (10-s) periods of exercise at six cranks velocities between 60-160 rpm, a linear inverse relationship between maximal peak torque and pedal crank velocity was observed. The peak torque-velocity relationship and the percentage decline in peak torque during 30 s exercise at 60,

100, and 140 rpm were reproducible within a given subject, the coefficient of variation was less than 10%. (13 refs.)

121067 Two-sidearm tracheal cannula for respiratory airflow measurements in small animals. J.P.Mortola, A.Noworaj (Dept. of Physiology, McGill Univ., Montreal, Quebec, Canada).
J. Appl. Physiol. (USA), vol.55, no.1, p.250-3 (July 1983).
Measurements of mean flow and tidal volume using four 2-sidearm tracheal cannulas (0.7, 1.5, 1.8, and 2.5 mm ID) are described. They have a linear response up to flows of 6, 10, 12, and 28 ml.s^{-1}, respectively, that correspond to 100 ml.s^{-1}.kg^{-1} or more, depending on the body size of the animals (15-350 g) in which they could be used. These characteristics, coupled with small volume and flow resistance, make the use of these cannulas as pneumotachographs a suitable and very practical way of measuring mean airflow and tidal volume in anesthetized small animals, ranging in size from newborn rats to newborn puppies. (6 refs.)

121068 A respiratory function jacket for measuring tidal volume and changes in FRC. D.W.Cartwright, G.A.Gregory, M.M.Willis (Dept. of Anesthesia & Pediatrics, Univ. of California, San Francisco, CA, USA).
J. Appl. Physiol. (USA), vol.55, no.1, p.263-6 (July 1983).
Describes a simple application of a mercury-in-rubber strain gauge in a jacket used to measure tidal volume in paralyzed, mechanically ventilated rabbits. The jacket produces a record with a straight base line. Shifts of this base line can be used to assess changes in functional residual capacity (FRC). (6 refs.)

121069 A programmable electrically braked ergometer. D.Giezendanner, P.E.di Prampero, P.Cerretelli (Dept. of Physiology, Univ. of Geneva, Geneva, Switzerland).
J. Appl. Physiol. (USA), vol.55, no.2, p.578-82 (Aug. 1983).
Research protocols require that the actual braking power (W_b) of electrically braked ergometers (EBE) is precisely set at the chosen power level, stable, and universally programmable. No commercially available EBEs appear to meet jointly the above conditions. In fact, EBE settings were found to deviate up to 25% from the reference level (W_R), their W_b to drop as a result of increased temperature as much as 30% within 1 h of continuous operation, and the programming features to be limited and rigid. To overcome the above pitfalls a procedure for building or improving EBEs is presented whereby (1) the stator of the brake used as a dynamometer is mounted on ball bearings, the torque being transmitted to a strain gauge; (2) the number of revolutions of the rotor is measured on a cogwheel by a proximity detector and an impulse counter; and (3) the torque and impulse number signals are fed into a low-priced microcomputer controlling the brake's power supply. The device has proved to be satisfactory in following any preprogrammed exercise-forcing functions. In the range ~10-500 W, $W_b = W_R \pm 1\%$. (11 refs.)

121070 A Hall effect transducer for measuring length changes in mammalian diaphragm. C.V.Peterson,Jr., A.B.Otis (Dept. of Physiology, Univ. of Florida, Gainesville, FL, USA).
J. Appl. Physiol. (USA), vol.55, no.2, p.635-41 (Aug. 1983).
Describes a length transducer useful for measuring length changes in the diaphragm of a dog which may be made by connecting a commercially available Hall generator to a Plexiglas plate ($5 \times 10 \times 3$ mm, 0.5 g), and suturing the plate to the surface of the muscle. A permanent magnet ($20 \times 10 \times 4$ mm, 1.5 g) is attached to the diaphragm at a distance of 2 or 3 cm along the expected direction of length change. Fine wires from the terminals of the Hall generator are connected to an external constant-current source and to solid-state circuitry which provides amplification, linearization, and temperature compensation of the output signal. Model experiments indicate that the length measurements may be accurate within 5% if the distance between the magnet and Hall generator is greater than 5 mm. With this type of transducer measurements of segmental length changes in the diaphragm of an anesthetized dog have been successfully recorded. (35 refs.)

121071 A computerized system for densitometric analysis of the microcirculation. B.R.Duling, D.N.Damon, S.R.Donaldson, R.N.Pittman (Univ. of Virginia School of Medicine, Charlottesville, VA, USA).
J. Appl. Physiol. (USA), vol.55, no.2, p.642-51 (Aug. 1983).
An analytical system for measuring size, motion, and light absorption of objects in the field of a microscope is described. The design criteria have been chosen to produce a system that permits acquisition of densitometric information at a number of points within the field and permits computation of important variables from the densitometric data. Relatively simple fiber-optics systems for sampling light intensity at selected locations in the microscope field are described. Computer programs are outlined that permit computation of microvessel diameter, red cell velocity, and hemoglobin oxygen saturation. The sampling systems and programs are quite general in nature and should be applicable to other types of related measurements and computing devices. (7 refs.)

121072 A close-range photogrammetric system for 3-D measurements and perspective diagramming in biomechanics. S.K.Ghosh (Dept. of Photogrammetry, Laval Univ., Quebec, Canada).
J. Biomech. (GB), vol.16, no.8, p.667-74 (1983).
Criteria considered in developing a close-range photogrammetric three-dimensional mapping system and its overall performance are discussed. The system consists of a stereophotographic capability of two cameras with synchronized shutters, a stereoplotting instrument with three-dimensional digitizing capability and a Calcomp plotter. Mapping of human knee-bones (femur and tibia) and perspective diagramming for various attitudes of one bone head with regard to the other are illustrated. The system works off-line with respect to the three principal components. The system is fully operational and is considered very efficient with regard to the current needs. (4 refs.)

121073 Unbiased linear property estimation for spheres, from sections exhibiting overprojection and truncation. K.R.Clarke, M.N.Moore (Inst. for Marine Environmental Res., Plymouth, England).
J. Microsc. (GB), vol.131, pt.3, p.311-22 (Sept. 1983).
In the biological sciences, stereological techniques are frequently used to infer changes in structural parameters (volume fraction, for example) between samples from different populations or subject to differing treatment regimes. Nonhomogeneity of these parameters is virtually guaranteed, both between experimental animals and within the organ under consideration. Techniques are therefore required for unbiased estimation of parameters from potentially small numbers of sample profiles. Unbiased estimates of linear properties are derived in one special case—the sampling of spherical particles by transmission microscopy, when the section thickness is not negligible and the resulting circular profiles are subject to lower truncation. The derivation uses the general integral equation formulation of Nicholson (1970); the resulting formulae are simplified, algebraically, and their efficient computation discussed. Bias arising from variability in slice thickness is shown to be neglible in typical cases. The strategy is illustrated for data examining the effects, on the secondary lysosomes in the digestive cells, of exposure of the common mussel to hydrocarbons. Prolonged exposure, at 30 μg l^{-1} total oil-derived hydrocarbons, is seen to increase the average volume of a lysosome, and the volume fraction that lysosomes occupy, but to reduce their number. (18 refs.)

121074 Stereoogy of tubular structures. A.Baddeley, P.Averback (Statistical Lab., Univ. of Cambridge, Cambridge, England).
J. Microsc. (GB), vol.131, pt.3, p.323-40 (Sept. 1983).
The morphology of a tubular structure can be characterized, in at least some of its important respects, through stereological methods. The authors study the geometric meaning of standard stereological quantities when applied to turbular structures, with particular regard to their curvature or tortuosity. Measures defined specifically in relation to tubular structures are also introduced for practical use. The ideal smooth bent cylinder, used, is not realistic but provides general principles from which a more specialized investigation should be developed. The emphasis is placed on simple counting methods of measurement, specifically the tangent counts introduced by DeHoff, and counts of section profiles exhibiting a particular character (such as 'figure-eights'). These measures convey information about the tortuosity of tubular structures, whereas the standard indices V_V, S_V, M_V give no information about tortuosity. Some data from human testicular tubules are discussed. (19 refs.)

121075 The complex-shaped 'perforated' synapse, a problem in quantitative stereology of the brain. D.M.G.De Groot, E.P.B.Bierman (Medical Biological Lab., Rijswijk, Netherlands).
J. Microsc. (GB), vol.131, pt.3, p.355-60 (Sept. 1983).
Failure to appreciate the consequences for stereological work of the simultaneous presence of complex-shaped perforated and disc-like non-perforated synapses in brain tissue results in underestimation of synaptic profile length and overestimation of synaptic density when measured in randomly selected ultrathin E-PTA slices. This problem can be solved by using serial slices and a calculation method which makes no assumptions about synaptic size and shape. A three-dimensional reconstruction is unnecessary. (19 refs.)

121076 Vascular smooth muscle orientation in straight portions of human cerebral arteries. J.G.Walmsley (Dept. of Biophys., Univ. of Western Ontario, London, Ontario, Canada).
J. Microsc. (GB), vol.131, pt.3, p.361-75 (Sept. 1983).
A technique of embedding, sectioning and analysis has been developed for studying the orientation and proportional composition of smooth muscle in the straight portions of human major cerebral arteries. Various distortions, which occurred during processing and sectioning, were measured quantitatively. Nerve fibres were implanted as a reference frame within the paraffin block containing an arterial bifurcation. The nuclei of smooth muscle have been treated as three-dimensional vectors of cellular orientation. The projected length in the plane of the section and the section thickness were used to define section pitch. The averaged pitch for the five sections from three straight portions was $-0.22° \pm 2.36$ (SD of five means) with a range between $-2.8°$ and 3.2°. Because this pitch is small it is possible to use 6.9 μm thick longitudinal and mid-plane sections of straight arteries to obtain estimates of proportional composition. Stereological point counting was used to determine that smooth muscle comprised $72.0\% \pm 4.76$ (SD for ten segments) of the tunica media in cerebral arteries. (32 refs.)

121077 Vascular smooth muscle orientation in curved branches and bifurcations of human cerebral arteries. J.G.Walmsley (Dept. of Biophys., Univ. of Western Ontario, London, Ontario, Canada).
J. Microsc. (GB), vol.131, pt.3, p.377-89 (Sept. 1983).
Two approaches were developed for determining reference axes and positions associated with bending tubular arteries and bifurcations from the human middle cerebral branching system. In the region of the bifurcation the orientation of groups of two-dimensional nuclear vectors was determined by the method of roses and average alignment. The reference axes and positions for these groups were determined from physical reconstructions of two bifurcations. The overall pattern in the bifurcation region was found to be random but there were significant differences between group orientations. The three-dimensional arterial direction vectors for three sections, from the bending arteries of one bifurcation, were determined. By taking the dot product of the three-dimensional nuclear vectors and these direction vectors, the pitch of individual nuclei was determined. The average pitch was $2.45° \pm 3.20$ (SD for $N=8$) with the largest mean pitch (6.14°) in the branch with the greatest curvature. Possible use of the three-dimensional approach for determining of smooth muscle orientation at bifurcations is discussed in general terms. (19 refs.)

121078 A microcomputer system for real-time analysis of cardiac action potentials. D.J.Sheridan, A.J.Bell, W.J.Penny, W.Culling (Dept. of Cardiology, Welsh Nat. School of Medicine, Cardiff, Wales).
J. Med. Eng. & Technol. (GB), vol.7, no.5, p.238-42 (Sept.-Oct. 1983).
A system for performing real-time analysis of cardiac action potentials has been developed using a microcomputer based on the Motorola 6800 central processor. Transmembrane potentials obtained using standard microelectrodes were digitized to 8 bits at 80 ms intervals, stored in cyclic memory buffer from which they could be selected for analysis, converted back to analogue form and displayed on an oscilloscope in real time. For each action potential, amplitude, the maximum rate of change of potential and the action potential duration at 50% repolarization and 100% repolarization were measured. In addition, conduction time (taken as the interval between the stimulus artefact and the action potential) was measured. All data were stored in memory and later printed, together with the time at which the recording was made. The system was designed for analysis of action potentials recorded using floating microelectrodes. The computer was controlled by three remote switches and a potentiometer, positioned close to the music bath. The program was written in Motorola 6800 assembly language and stored in erasable programmable read-only memory. (13 refs.)

121079 A differential capacitive transducer for continuous recording the mass flows through epithelia by immersion weighing. H.Vais (Membrane Biophysics Group, Inst. of Biological Sci., Bucharest, Rumania), D.-G.Margineanu.
J. Biomed. Eng. (GB), vol.5, no.4, p.340-2 (Oct. 1983).
The experimental set-up specifically for recording the weight changes involved in the measurements by immersion weighing of the osmotic and isotopic mass flows through epithelia is described. It allows the conversion of any common mechanical microbalance into a device able to record mass flows at 10^{-6} Kg.m^{-2}.s^{-1} sensitivity. (1 ref.)

121080 A waveguide pulse-echo system for ultrasonic absorption measurements in biological media. B.Woodward (Electronic & Electrical Engng. Dept., Loughborough Univ. of Technol., Loughborough, England).
J. Biomed. Eng. (GB), vol.5, no.4, p.343-8 (Oct. 1983).
The system described has been designed for measurements of ultrasonic absorption in suspensions of biological cells. A novel feature of the design is the provision of a waveguide sample tube which prevents beam diffraction. This ensures that the ultrasonic energy is wholly constrained between a single transducer and a moveable air-backed reflector, and is lost only by absorption in the sample. The associated electronics comprises a simple ultrasonic generator with variable power output, carrier frequency and mark-space ratio,

and a digital thermometer with a thermistor probe for measuring the sample temperature. (14 refs.)

121081 An activity meter. A.Witkowski.
Pol. Tech. Rev. (Poland), no.1, p.15-16 (1983).
An original instrument called the AW-3 activity meter which makes it possible to determine the physiological values of the limiting concentrations of chemical substances for the aquatic organisms being tested is described. The AW-3 meter can be used for testing the motorial reactions to stimuli such as chemical substances, or light. (no refs.)

121082 The use of a versatile specimen holder to prepare cultured cells for scanning electron microscopy. P.Evers, K.Robinson, L.Maistry (Electron Microscope Unit, Univ. of Natal, Durban, S Africa).
Scanning Electron Microsc. (USA), pt.1, p.333-42 (1983). (Scanning Electron Microscopy 1983 Conference, Dearborn, MI, USA, 17-22 April 1983).
Cells from a human esophageal carcinoma cell line characterized by abundant microvilli and extensive lateral processes were grown on glass coverslips and processed for scanning electron microscopy. In order to reduce possible artifacts related to movement the cultured cells were fixed directly in situ at 37°C and transported for subsequent processing in a specially designed carrier. During dehydration and critical point drying, the cultures were confined in a versatile holder that avoided accidental air drying and required only small volumes of reagents. Flattening of the superficial microvilli on all cells and of processes on mitotic cells was prevented. Extensive fracture of the lateral processes was reduced. Despite the absence of a washing step, debris was minimal and cells of high quality were observed. (14 refs.)

121083 Pumonary macrophage phagocytosis: quantification by secondary and backscattered electron imaging. D.B.Warheit, L.H.Hill, A.R.Brody (Lab. of Pulmonary Function & Toxicology, Nat. Inst. of Environmental Health Sci., Research Triangle Park, NC, USA).
Scanning Electron Microsc. (USA), pt.1, p.431-7 (1983). (Scanning Electron Microscopy 1983 Conference, Dearborn, MI, USA, 17-22 April 1983).
A systematic method for quantifying phagocytosis of carbonyl iron heads by pulmonary macrophages is described. These techniques utilize secondary and backscattered electron imaging. The carbonyl iron components has a high atomic contrast number which makes it ideal for visualization in the backscatter electron image of the scanning electron microscope. As a result, interiorized iron beads can easily be distinguished from beads attached to the surface of the cell. The morphology and phagocytic capacities of individual macrophages were compared. The results showed that functional heterogeneity exists within the normal pulmonary macrophage population. Ruffled macrophages avidly phagocytized carbonyl iron beads, while smooth cells were functionally impaired. In addition, macrophages which were altered morphologically by exposures to acidic culture conditions or to asbestos demonstrated a decreased capacity to phagocytize carbonyl iron beads. Accordingly, the surface morphology of pulmonary macrophages correlated with their phagocytic capacities. The authors propose that results obtained from the analyses of individual cells can be used to study the phagocytic capacity of macrophage populations. (15 refs.)

121084 Mechanical characterization of membranelike biological tissue. L.E.Thibault (Dept. of Bioengng., Univ. of Pennsylvania, Philadelphia, PA, USA), D.L.Fry.
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.31-8 (Feb. 1983). [received: Oct. 1983]
Experimental and analytical methods are presented which enable one to examine the local rheological properties of biological tissues which can be captured as flat sheets between matching pressure manifolds and deformed under experimentally prescribed hydrostatic loading conditions. In spite of the fact that most biological tissues, including arteries, are nonlinearly elastic when considered over wide ranges of strain, it was found that the deformation of swine and canine arterial wall specimens in the physiological range of wall strain can be approximated by an isotropic, linearly elastic membrane model. In view of this, the elastic behaviour was characterized approximately by an incremental modulus in both species was shown to increase by a factor of three along the descending thoracic aorta from the ductus scar to the celiac orifice. (8 refs.)

121085 Determination of the local erosion stress of the canine endothelium using a jet impingement method. R.N.Vaishnav, D.J.Patel, H.B.Atabek, M.D.Deshpande, F.Plowman, J.Vossoughi (School of Engng. & Architecture, Catholic Univ. of America, Washington, DC, USA).
Trans. ASME. J. Biomech. Eng. (USA), vol.105, no.1, p.77-83 (Feb. 1983). [received: Oct. 1983]
A method to determine local endothelial erosion stress is presented. Freshly excised segments of middle descending thoracic aortas of dogs were slit open longitudinally and stretched in a specially designed rack to various circumferential and longitudinal dimensions. Jets of physiological saline were impinged normally on the endothelium of these segments. Lesions caused by the jet were made visible by staining the tissue with Evans blue dye. The dye solution was absorbed by regions where the endothelial layer had been damaged or destroyed. Characteristically, the lesions were annular in shape. This indicates that the endothelium can withstand large normal stresses where the jet impinges, but is eroded by the shear stress resulting from the jet efflux. Erosion stress of the endothelium was determined by correlating the external radius of a lesion with the shear stress expected at that radial distance from the center of the jet. The importance of the method is its ability to measure local endothelial erosion stress which is of particular significance in the study of the discrete process of atherogenesis. (17 refs.)

121086 The improvement and quantitative assessment of B-mode images produced by an annular array/cone hybrid. M.S.Patterson, F.S.Foster (Dept. of Medical Biophys., Univ. of Toronto, Toronto, Ontario, Canada).
Ultrason. Imaging (USA), vol.5, no.3, p.195-213 (July 1983).
Hybrid ultrasound imaging systems, which combine spherical focusing on transmit with axicon focusing on receive, provide excellent resolution over a useful depth of field. The authors present a new hybrid design with improved sensitivity, in which the axicon focusing is achieved by two conical mirrors and a PZT 5A disk cut into 8 sectors. The authors have investigated two methods of processing the signals from the 8 sectors. In the first, phase insensitive sector addition (PISA), the B-scan is formed from the sum of the 8 demodulated signals. In the second, multiplicative processing (MP), the 8 RF waveforms are multiplied and the resultant is demodulated to form the image. Both techniques result in smoothed speckle but degraded lateral resolution. As well, MP decreases the off-axis sensitivity of the system and artifacts characteristic of axicon focusing. Quantitative assessment of the effects of PISA and MP was performed using a new approach called contrast-to-speckle ratio (CSR). The CSR data, which is a measure of the image contrast of cylindrical voids in a random scattering medium relative to contrast fluctuations due to speckle, shows the superiority of PISA and MP. This conclusion is supported by images of in vitro human breast tissue. (23 refs.)

Scanning Electron Microscopy 1983 Conference ....See Entry 116926
First International Conference on Advances in Ferrography ..See Entry 116927
Quantitative serial sectioning analysis: preview ....See Entry 117228
Distribution-free estimation of sphere size distributions from slabs showing overprotection and truncation, with a review of previous methods ....See Entry 117229
Soft X-ray imaging microscopy using zone plates and nonsynchrotron sources . ...See Entry 117297
Bone stress in the horse forelimb during locomotion at different gaits: a comparison of two experimental methods ....See Entry 120903
Joint models, degrees of freedom, and anatomical motion measurement ....See Entry 120932
Response of an advanced head-neck model to transient loading ....See Entry 120933
Generation of separate density and compressibility images in tissue ....See Entry 120973
Steady-state analysis and evaluation of a new thermal sensor for surface measurements of tissue perfusion ....See Entry 121030

87.90 OTHER TOPICS IN BIOPHYSICS, MEDICAL PHYSICS, AND BIOMEDICAL ENGINEERING

The canopy coupling index of a tropical forest ....See Entry 121317
Atmospheric composition: influence of biology ....See Entry 121343
On the effect of interstellar gas on atmospheric oxygen and terrestrial life ....See Entry 121377

90.00 GEOPHYSICS, ASTRONOMY AND ASTROPHYSICS

91.00 SOLID EARTH GEOPHYSICS

91.10 GEODESY AND GRAVITY

(for relations of gravity observations to tectonics and isostasy, see 91.45 Physics of plate tectonics)

121087 On the existence and singularity of a potential in the inverse problem with a priori information on source distribution. M.A.Brodskiy, N.S.Nadirashvili (O.Yu. Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.8, p.591-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli,* vol.18, no.8 (1982). [received: Sept. 1983]
Conditions studied under which a harmonic function in free space is an external potential of masses with positive density. A number of theorems are obtained for the uniqueness of determining these masses and for approximation methods for their external fields. (10 refs.)

121088 The rotation of the ocean-solid Earth system. S.R.Dickman (Dept. of Geological Sci., State Univ. of New York, Binghamton, NY, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6373-94 (10 Aug. 1983).
It is shown that the long-period, highly elliptical Markowitz wobble can be viewed as a natural wobble of the coupled mantle-ocean system. From a rotational point of view, oceanic wobble is possible even if the oceans respond in an equilibrium a manner to wobble because the oceans are nonglobal and a thin layer; either of the latter conditions, or an oceanic response which is nonequilibrium, can maintain the separation of rotation and figure axes constituting wobble. Characteristics of the uncoupled bodies are first determined. The inertia tensor of the oceans yields an oceanic body whose free wobble is retrograde and short period under the assumption of an equilibrium fluid response; it also yields an oceanless earth whose precessional constant more nearly equals the hydrostatic rather than the observed whole Earth value. The equations governing wobbles of a coupled two-body system, rigid or deformable, are developed and referred to the same wobbling coordinate system. Solutions are found for various general types of coupling. (39 refs.)

121089 Map projection transformation with digitally controlled differential rectifiers. G.E.Bormann (Wild Heerbrugg Ltd., Heerbrugg, Switzerland), E.Vozikis.
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.9, p.1317-23 (Sept. 1983).
The geometrically correct transformation of the entire map content from one cartographic projection to another is an old problem. It can be solved economically with digitally-controlled differential rectifiers such as the Wild AVIOPLAN OR1, using additional software modules. Examples illustrate the potential of this method and show also the great advantages of the color capability of the OR1 system. (3 refs.)

121090 Modelling of vertical crustal movements by means of collocation. E.Kanngieser.
Z. Vermessungswes. (Germany), vol.108, no.9, p.373-81 (Sept. 1983). In German.
The proposed technique utilizes least-squares collocation for producing a common and continuous model of vertical crustal movements. The data used are the results of repeated levellings and precise gravity measurements. A position-time system is the reference for the sample points where height and/or gravity have been observed. The necessary covariance functions have been determined empirically, analyzed regarding the isotropy and used for the prediction of the variations. The developed algorithm has been applied successfully to data obtained in a geodynamic test field in Iceland. (23 refs.)

121091 Unbiased estimation of variance-covariance components in condition adjustment with unknowns—a MINQUE approach. L.E.Sjoberg (Dept. of Geodetic Sci., Stuttgart Univ., Stuttgart, Germany).
Z. Vermessungswes. (Germany), vol.108, no.9, p.382-7 (Sept. 1983).
The MINQUE Theory of variance-covariance component estimation is extended to condition adjustment with unknowns. Estimation by the general

Gauss-Markov model and by the condition adjustment model come out as special cases. (8 refs.)

121092 The influence of non-orthogonal eccentric theodolite axes on the circle readings. G.Brandstatter.
Z. Vermessungswes. (Germany), vol.108, no.9, p.387-93 (Sept. 1983). In German.
In the case of eccentric theodolite axes the reading errors differ from the reading errors of the usual centric constructions. This effect is derived for the case of eccentricities in all directions by vector calculus, and scalar equations of the influence in vertical and horizontal circle readings are given. Finally the equations are specialized for two typical cases. (5 refs.)

Geodetic measurements of postseismic crustal deformation following the 1979 Imperial Valley earthquake, California .... See Entry 121187

Influence of plate subduction on isostatic compensation in northern California ....See Entry 121190

Early Tertiary subduction zones and hot spots ....See Entry 121198

Vertical movements along the margins of the Atlantic Ocean ....See Entry 121202

Geophysical approach to the structural interpretation of the Lake Becancour region, Thetford Mines, Quebec ....See Entry 121233

Haughton impact structure: structural and morphological aspects ....See Entry 121247

Homomorphic deconvolution of potential field data in one and two dimensions ....See Entry 121386

Pulse-to-pulse correlation in satellite radar altimeters ....See Entry 121505

91.25 GEOMAGNETISM AND PALAEOMAGNETISM; GEOELECTRICITY

121093 Inversion of geophysical electromagnetic measurements, limitations and approximate solutions. S.-E.Hjelt.
Acta Polytech. Scand. Appl. Phys. Ser. (Finland), no.Ph138, p.58-62 (1983).
The paper presents a brief summary of the main limitations of inverting electromagnetic (EM) data into useful descriptions of the Earth and its structures. Problems of modelling, uniqueness and resolution are stated. Despite theoretical shortcomings, approximate inversion procedures are useful in the practical use of EM methods. Analog principles can be used to extend the domain of existing model solutions, the theory of images to calculate approximate responses of good conductors and apparent current distributions to model real structures of the Earth. (18 refs.)

121094 New paleomagnetic data for the Triassic Guichon batholith of south-central British Columbia and their bearing on Terrane I tectonics. D.T.A.Symons (Dept. of Geology, Univ. of Windsor, Windsor, Ontario, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.8, p.1340-4 (Aug. 1983).
The 198 Ma Guichon batholith outcrops in the southern end of the Intermontane Belt or composite Terrane I of the western North American Cordillera. Thermal demagnetization of specimens isolates a stable primary component giving a pole position of 347°W, 52°N. These data support earlier results that indicate the batholith has undergone a clockwise rotation about a vertical axis of $\sim 43 \pm 7°$. They also show that the batholith has undergone northward motion of $13 \pm 6°$, which supports recent arguments that the terrain underwent $14 \pm 2°$ of northward translation between Late Cretaceous and pre-Miocene time. (40 refs.)

121095 Late Cretaceous apparent polar wander of the Pacific plate: evidence for a rapid shift of the Pacific hotspots with respect to the spin axis. R.G.Gordon (Dept. of Geological Sci., Northwestern Univ., Evanston, IL, USA).
Geophys. Res. Lett. (USA), vol.10, no.8, p.709-12 (1983).
Paleomagnetic data from the Pacific plate show that the average azimuth of the Pacific plate decreased by $\sim 12°$ between 90 Ma and 81 Ma, whereas trends of Late Cretaceous seamount chains suggest that the Pacific plate moved northwestward relative to the hotspots with little change in azimuth during the same time interval. This difference is used to infer a $13° \pm 4°$ shift of the spin axis relative to the hotspots in the Pacific Ocean basin. This shift occurred within 5 m.y. of the occurrence of anomalous behavior of the paleomagnetic field recorded in anomalies 33 and 34. This coincidence in timing suggests there may be a causal link between these three phenomena. (30 refs.)

121096 Matching long term periodicities of geomagnetic reversals and galactic motions of the solar system. J.G.Negi, R.K.Tiwari (Nat. Geophys. Res. Inst., Hyderabad, India).
Geophys. Res. Lett. (USA), vol.10, no.8, p.713-16 (1983).
To understand the phenomenon of frequent reversals of axial geocentric dipole fields it is essential to understand the spectral structure of geomagnetic reversal series and search for possible exogenetic (cosmic) factors associated with its dynamic behaviour. A scheme of Walsh spectrum analysis has been applied, for the first time, to the available world-wide paleomagnetic measurements during Phanerozoic (last 570 million years). The results postulate long-term cyclicity in magnetic stratigraphy with reversal periods of 285, 114, 64, 47 and 34 million years with distinct resolution. The similar analysis was further repeated by dividing the total record in two sub-series. These results indicate mean periods of 71, 47 and 32 m.y. The maximum spectral power is found for the Cosmic year (285 m.y.) Term (period of complete revolution of solar system around the Milky way galactic centre). (21 refs.)

121097 Annual report for magnetic observatories—1981. G.jansenvan-Beek.Jansen van Beek,G., R.L.Coles.
Geomagn. Ser. Earth Phys. Branch (Canada), no.24, p.1-54 (1983). In English, French.
The Canadian Magnetic Observatory Network in 1981 consisted of 12 observatories with the Automatic Magnetic Observatory System (AMOS) in operation at all sites except Alert and Mould Bay. All observatories now record the orthogonal elements X(north), Y(east), and Z(vertical), although back-up systems are maintained in H,D,Z for reasons of continuity at the Kp and Kn observatories. The Telephone Verification System (TVS) is available for monitoring data from all AMOS sites. A digital back-up system for AMOS was in operation at all stations. The location, method of recording, and data of commencement of the observatories are given. The geomagnetic values recorded during 1981 are presented in this report. (12 refs.)

121098 Study of the temporal dynamics of the Manchazh regional magnetic anomaly. V.A.Shapiro (Inst. of Geophys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.8, p.598-606 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.8 (1982). [received: Sept. 1983]
Results are presented for geomagnetic studies of the Manchazh regional magnetic anomaly in 1959-79. This was a repeat aeromagnetic survey. The author discusses ground T-observations along a grid of reference points—1968-79, observations at the ARti and Vyskaya Dubrava Observatories-1968-79, and synchronous magnetovariational observations of T at four points: the anomaly epicenter, the Arti Observatory, and at two points in the normal field-1974 and 1977. It is shown that the anomalous magnetic field in the Machazh anomaly increased in the course of 20 years at a rate on the order of 5 (nanoteslas) per year and that the anomaly was caused by a rock mass lying at a depth of 10-40 km and having generally remanent magnetization, the direction of which coincides with the direction of the contemporary mangetic field. (21 refs.)

121099 Effect of deep fractures on the resolution capacity of magnetotelluric sounding. V.I.Dmitriyev, M.N.Berdichevskiy, I.S.Barashkov, N.A.Lebedeva (M.N. Lomonosov Moscow State Univ., Moscow, USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.8 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.8, p.623-4 (1982). [received: Sept. 1983]
A two-dimensional model is considered which simulates the crustal conducting zone crossed by deep fractures. High resolution capability is indicated for magnetotelluric sounding. (1 ref.)

121100 Energy characteristics of non-homogeneous planar electromagnetic waves. V.B.Shaub, N.N.Barinov, S.S.Starzhinskiy (Pacific Ocean Oceanographic Inst., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.8 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.8, p.625-8 (1982). [received: Sept. 1983]
The electrical characteristics are considered for electrical and magnetic modes of non-homogeneous planar waves in a magnetotelluric field. Based on the experimental data, it is indicated that the directions and absolute values of group velocities for these modes differ considerably in some realizations, while in others they are rather close to one another, which is evidence for a differing degree of correspondence for these realizations to models for non-homogeneous planar waves. (6 refs.)

121101 The problem of constructing a magnetic model of the Earth's crust as illustrated by a latitudinal traverse of the Urals. V.A.Shapiro, A.V.Tsirul'skiy, F.I.Nikonova, N.V.Fedorova, O.Ya.Belyayeva, L.O.Tyurmina, A.V.Chursin (Geophys. Inst., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.9, p.672-80 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.9 (1982). [received: Sept. 1983]
Methodological questions arising during the construction of a magnetic model of the Earth's crust are discussed: the determination of the anomalous magnetic field, the choice of the model of the principal geomagnetic field, the interpretation of magnetic anomalies. The results of the construction of a model of a magnetically active layer along the Gayna-Gornopravdinsk geotraverse, which is 900 km long and intersects the main structures of the Urals, are presented. The necessity of taking equivalence into account in the inverse problem of magnetometry is stressed. (19 refs.)

121102 Equivalent ionospheric current systems representing lunar daily variations of the polar geomagnetic field. S.Matsushita, Wen-Yao Xu (High Altitude Obs., Nat. Center for Atmospheric Res., Boulder, CO, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.7143-54 (1 Sept. 1983).
Equivalent ionospheric current systems of the lunar daily geomagnetic variations at both high and mid-low latitudes during a solar active period are estimated from geomagnetic data for three seasons and the yearly average. Clear convective currents at high latitudes are found in addition to the well-known mid-low latitude current system. Field-aligned electric currents as well as the wind dynamo effects which produce the obtained electric current systems for the semidiurnal variation are examined. It is concluded that the wind dynamo plays a basic role in producing the current system at high latitudes, since lunar effects on the field-aligned current distribution are difficult to explain. (21 refs.)

121103 A Pennsylvanian paleomagnetic pole from the mineralized Late Cambrian Bonneterre Formation, southeast Missouri. M.J.Wisniowiecki, R.Van der Voo, C.McCabe, W.C.Kelly (Dept. of Geological Sci., Univ. of Michigan, Ann Arbor, MI, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6540-8 (10 Aug. 1983).
One hundred eighty-eight oriented samples of the Late Cambrian Bonneterre carbonates of southeastern Missouri were taken from Viburnum Trend mines and local surface outcrops. Initial natural remanent magnetization directions have south-southeasterly declinations and downward inclinations. Progressive demagnetizations using thermal and AF techniques give two directions: one is a viscous present-day field direction, and the other is of reversed polarity, with south-southeasterly declinations and very shallow inclinations. The resulting paleopole, at 43°N, 126°E, is located near the Pennsylvanian to Early Permian segment of the North American apparent polar wander path. A negative conglomerate test supports this assignment for the magnetization age. (36 refs.)

121104 Palaeomagnetism of Lower Cretaceous tuffs from Yukon-Kuskokwim delta region, western Alaska. B.R.Globerman, R.S.Coe, J.M.Hoare, J.Decker (Earth Sci. Board, Univ. of California, Santa Cruz, CA, USA).
Nature (GB), vol.305, no.5934, p.516-20 (6 Oct. 1983).
New palaeomagnetic results are reported from tuffs and associated volcaniclastic rocks of early Cretaceous age from the Yukon-Kuskokwim delta region in western Alaska. These rocks were probably overprinted during the Cretaceous long normal polarity interval. This overprint direction is not appreciably discordant from the expected late Cretaceous direction for cratonal North America. The implied absence of appreciable northward displacement for this region is consistent with the general late Mesozoic-early Tertiary tectonic pattern for Alaska, based on more definitive studies: little to no poleward displacement for central Alaska, though substantially more northward drift for the 'southern Alaska terranes' (comprising Alaska Peninsula, Kodiak Island, Prince William Sound area, and Matunuska Valley) since late Cretaceous to Palaeocene time. (43 refs.)

On the existence and singularity of a potential in the inverse problem with a priori information on source distribution ....See Entry 121087

Effective conductivity of anisotropic medium with large number of cracks ....See Entry 121138

Determination of timing of volcanic events by secular variation and thermal modeling ....See Entry 121181

Rotation of the Peruvian Block from palaeomagnetic studies of the Central Andes .... See Entry 121201

Vertical movements along the margins of the Atlantic Ocean .... See Entry 121202

Detrital remanent magnetization in hematite .... See Entry 121227

Geophysical approach to the structural interpretation of the Lake Becancour region, Thetford Mines, Quebec .... See Entry 121233

Some distinctive features of the crustal structure and metallogeny of the southern frame of the Siberian platform .... See Entry 121240

Haughton impact structure: structural and morphological aspects .... See Entry 121247

Homomorphic deconvolution of potential field data in one and two dimensions .... See Entry 121386

The use of Magsat data to determine secular variation .... See Entry 121394

A new rock-magnetic approach to selecting sediments for geomagnetic paleointensity studies: application to paleointensity for the last 400 years .... See Entry 121395

Structure of South Atlantic anomaly in maximum of 21st solar cycle by satellite IC-Bulgaria-1300 data .... See Entry 121456

Solar wind stream characteristics and low latitude geomagnetic field changes .... See Entry 121466

Pi 2 pulsations in the Indian equatorial region .... See Entry 121467

91.30 SEISMOLOGY

121105 Energy radiation from a spherically symmetric homogeneous source. J.W.Rudnicki (Dept. of Civil Engng., Northwestern Univ., Evanston, IL, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.901-8 (Aug. 1983).
General expressions for energy radiated from seismic sources in linear elastic bodies are illustrated and clarified by examining the energy radiated from a spherically symmetric source. Calculations with the spherical source demonstrate that the point source approximation for the radiated energy is not asymptotic in the sense that it does not approach the actual radiated energy for small source dimension. Comparison between the energies radiated from the spherical source for a ramp time function and for a modulated ramp is discussed. (12 refs.)

121106 On the Green's functions for a layered half-space. I. J.E.Luco (Dept. of Appl. Mech., Univ. of California, La Jolla, CA, USA), J.Apsel.
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.909-29 (Aug. 1983).
A method to calculate the dynamic three-dimensional response of a layered half-space to an arbitrary buried source is presented. The frequency-domain formulation is based on representing the complete response in terms of semi-infinite integrals with respect to wavenumber after expansion in a Fourier series with respect to azimuth. The integrands for each wavenumber and frequency are determined by an efficient factorization in terms of generalized transmission and reflection coefficients which are calculated by an iterative scheme. Time-domain results may be obtained by Fourier synthesis over frequency. (26 refs.)

121107 On the Green's functions for a layered half-space. II. R.J.Apsel (Sierra Geophys. Inc., Redmond, WA, USA), J.E.Luco.
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.931-51 (Aug. 1983).
For pt.I see ibid., vol.73, no.4, p.909-29 (1983). A numerical procedure to obtain the dynamic Green's functions for layered viscoelastic media is presented. The procedure is based on numerical evaluation of certain Hankel-type integrals which appear in an integral representation derived by Luco and Apsel (1983). Comparisons illustrating the accuracy and flexibility of the approach are made with a number of solutions obtained by other methods. (10 refs.)

121108 A specific barrier model for the quantitative description of inhomogeneous faulting and the prediction of strong ground motion. II. Applications of the model. A.S.Papageorgiou, K.Aki.
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.953-78 (Aug. 1983).
For pt.I see ibid., vol.73, no.3, p.693-722 (1983). The specific barrier model, which was described in detail by Papageorgiou and Aki (1983), is applied to a set of five moderate to strong Californian earthquakes: Kern County (1952); San Fernando (1971); Borrego Mountain (1968); Long Beach (1933); and Parkfield (1966). Source parameters such as barrier intervals, local stress drops, cohesive zone size, and cohesive stress are inferred. The cut-off frequency observed on the source acceleration power spectra of all the events analyzed, is interpreted in terms of the cohesive zone size and cohesive stress which arrest the localized fractures that occur on the fault plane. The relation between barrier interval and maximum slip which has been observed by Aki et al. (1977) is verified. (49 refs.)

121109 Source characterization of bermed surface bursts. B.W.Stump.
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.979-1003 (Aug. 1983).
A source characterization of bermed surface bursts utilizing vertical and horizontal point sources is developed. The equivalence of this formulation with a radial force couple and vertical point force is shown. This representation is formulated so that with analytic propagation path models and observational data, inverse techniques can be applied and the source estimated. The inverse procedure is appled to the Pre-HYBRID GUST 1-04, 05, and 06 data sets (13.6 kg for 04, 13.6 kg for 05, and 39 kg for 06 of sand bermed C-4). (20 refs.)

121110 The apparent attenuation of a scattering medium. P.G.Richards, W.Menke (Lamont-Doherty Geological Obs., Columbia Univ., Palisades, NY, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1005-21 (Aug. 1983).
Reports the results of some numerical experiments that bring out the low-pass characteristics of a purely elastic medium with a heterogeneous velocity structure. Although the typical fluctuation is spatially confined within less than a wavelength, waves propagating over a sufficiently long path suffer major cumulative effects. The authors summarize the removal of high frequencies during transmission by a frequency-independent apparent Q, and show that attenuation by intrinsic friction and scattering are approximately additive. The authors propose some diagnostics that might help to distinguish the presence of velocity fluctuations and resultant scattering from the presence of anelasticity and true dissipation. The authors also outline several topics in the theory of wave propagation that will be relevant in a satisfactory interpretation of short-period observations, if the amplitude of such signals is affected by scattering. (25 refs.)

121111 Generalization of Higuchi's conditions for Love waves propagating through two welded quarter-spaces with two surface layers on each. M.H.Kazi, A.Niazy (Univ. of Petroleum & Minerals, Dhahran, Saudi Arabia).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1023-30 (Aug. 1983).
Higuchi (1932) considered a medium consisting of two quarter-spaces in welded contact, each having a single homogeneous layer of the same thickness overlying a homogeneous half-space, and gave conditions on the rigidities and densities of the two layers and two half-spaces in such a way that the plane Love waves normally incident on the vertical plane generate only reflected and transmitted Love waves without mode conversion or body-wave scattering. The authors generalize Higuchi's results to two layers overlying a half-space divided by a vertical plane. (8 refs.)

121112 *Lg* spectra of local earthquakes recorded by the Eastern Canada Telemetered Network and spectral scaling. H.S.Hasegawa (Div. of Seismology & Geomagnetism, Energy, Mines & Resources, Ottawa, Ontario, Canada).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1041-61 (Aug. 1983).
A spectral analysis of more than 300 Eastern Canada Telemetered Network records of the *Lg* wave from 103 eastern Canada earthquakes is undertaken to determine source characteristics. Both seismic moment and corner frequency of smaller magnitude ($1 \leq M \leq 4.2$) earthquakes increase more gradually with increasing magnitude (M stands for m_{bLg}) than do corresponding parameters for larger ($4.2 < M \leq 6.6$) earthquakes. For smaller and larger earthquakes, empirical relations are presented. (39 refs.)

121113 Body-wave amplitude and travel-time correlations across North America. T.Lay, D.V.Helmberger (Seismological Lab., Californian Inst. of Technol., Pasadena, CA, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1063-76 (Aug. 1983).
Relationships between travel-time and amplitude station anomalies are examined for short- and long-period *SH* waves and short-period *P*-waves recorded at North American WWSSN and Canadian Seismic Network stations. Data for two azimuths of approach to North America are analyzed. To facilitate intercomparison of the data, the *S*-wave travel times and amplitudes are measured from the same records, and the amplitude data processing is similar for both *P* and *S* waves. (28 refs.)

121114 Bayesian analysis of extreme earthquake occurrences. II. Application to the San Jacinto fault zone of southern California. K.W.Campbell (TERA Corp., Berkeley, CA, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1099-115 (Aug. 1983).
For pt.I see ibid., vol.72, no.5, p.1689-705 (1982). The Bayesian extreme-value distribution of earthquake occurrences developed in Campbell (1982), is tested and applied to the estimation of seismic hazards for the San Jacinto fault zone of southern California. Prior estimates of seismicity are developed from seismotectonic data based on standard seismological relationships among seismic moment, slip rate, earthquake recurrence rate, and magnitude. These estimates are then updated using Bayes' theorem and historical estimates of seismicity associated with the San Jacinto fault zone. (48 refs.)

121115 Seismicity in the St. Elias region of northwestern Canada and southeastern Alaska. R.B.Horner (Dept. of Energy, Mines & Resources, Pacific Geosci. Centre, British Columbia, Canada).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1117-37 (Aug. 1983).
Examines seismicity patterns in the St. Elias region in relation to the major tectonic features. Zones of earthquake occurrence are defined both spatially and temporally on the basis of historical activity and, particularly along the Denali system in the southwest Yukon, low-level monitoring and microearthquake activity. An estimate is made of the slip rate and accumulated elastic strain. (42 refs.)

121116 A study of the 20 January 1982 earthquake near Great Nicobar Island, India. P.N.Agrawal (Dept. of Earthquake Engng., Univ. of Roorkee, Roorkee, India).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1139-59 (Aug. 1983).
An earthquake of $M_s = 6.3$ occurred on 20 January 1982 near the east coast of Great Nicobar Island (in the Bay of Bengal), India and caused great panic among the inhabitants. Ground fissures and damage to civil engineering structures was also caused. A study comprised of the recording of aftershocks and their migration, the preparation of an isoseismal maps, and the compilation of other damage data is presented. Some recommendations are made to permit suitable safeguards in future development. (8 refs.)

121117 A teleseism-specific detection algorithm for single short-period traces. J.R.Evans (US Geological Survey Office of Earthquake Studies, Menlo Park, CA, USA), S.S.Allen.
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1173-86 (Aug. 1983).
An algorithm for microprocessor-controlled seismographic recorders is described which realiably detects major phases from earthquakes more than 3° from the sensor but rejects noise events and most earthquakes closer than 3°. Unusually large earthquakes within 3° also are detected. The algorithm is applicable to field studies using triggered seismographs to record teleseismic *P*-waves, to worldwide network automation, and to scanning records for teleseisms. It uses two band-pass filtered data streams evolved from a single short-period vertical-component seismometer to differentiate (low-frequency) teleseisms from other signals; the low-frequency band (0.5 to 2.0 Hz) declares 'triggers' while the high-frequency band (3.0 to 8.0 Hz) inhibits any of these triggers generated by broadband signals such as local earthquakes. (22 refs.)

121118 Microfilming of historical seismograms from the Mount Hamilton (Lick) Seismographic Station. R.A.Uhrhammer (Seismographic Station, Univ. of California, Berkeley, CA, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1197-202 (Aug. 1983).
The seismograms from the Mount Hamilton, California, seismographic station were microfilmed as part of the Historical Seismogram Filming Project. All of the available smoked paper and photographic seismograms from the Mount Hamilton station (more than 35000 from 6 June 1911 through 30 June 1962) were prepared and microfilmed onsite at the University of California, Berkeley. The preparation time averaged 2 man-minutes/seismogram, and the overall cost averaged out to $1.05/seismogram. (7 refs.)

121119 Uncertainties in probabilistic seismic hazard assessment as a function of probability level: a case history for Vancouver, British Columbia. G.M.Atkinson, R.G.Charlwood (Klohn Leonoff Consulting Engnrs., Richmond, Canada).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1225-41 (Aug. 1983).
The stability of probabilistic methods of evaluating expected strong ground motion levels is examined as a function of probability level. A case history for Vancouver, British Columbia, is used to show that when input parameters are screened on the basis of compatibility with low probability calculations, robust (±25 per cent) results are obtained for probabilities in the range of 10^{-2} to 10^{-4} per annum. There is no inherent loss of stability with decreasing probability. Probabilistic approaches are not in conflict with deterministic approaches, since deterministic data can be incorporated into the analysis.

The usefulness of the probabilistic approach lies in providing a framework for evaluating uncertainties. (23 refs.)

121120 Mode of strain release of three graben-associated earthquakes. W.-Y.Chung (Dept. of Geology, Univ. of South Carolina, Columbia, SC, USA).
Tectonics (USA), vol.2, no.4, p.379-98 (Aug. 1983).
The nature of graben-associated earthquakes sequences using various seismological, geophysical and geological data. The three earthquake sequences are the Hsingtai, China earthquakes (maximum magnitude Ms=7.2) of March, 1966, the Nevada earthquakes (maximum M=7.1) of 1954, and the New Madrid earthquakes (maximum Ms=8.8) of 1811-12. These earthquake sequences represent a unique mode of strain release away from plate margins and have bearings on earthquake hazard evaluation. Similarities between these earthquake sequences are studied. It is noted that the largest shock in a sequence is not usually the first one. Epicentre migration occurred in two of these sequences. (73 refs.)

121121 Crosshole seismology and seismic imaging in crystalline rocks. J.Wong, P.Hurley, G.F.West (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada).
Geophys. Res. Lett. (USA), vol.10, no.8, p.686-9 (1983).
A borehole-to-borehole audiofrequency seismic system using piezoelectric transducers as active elements has been developed and used to investigate crystalline rocks in Canada. High-quality seismograms have been recorded for transmitter-receiver distances of up to 230 meters. It has been found that both travel times and signal amplitudes provide diagnostic information about rock quality. Two-dimensional images of seismic velocity and transparency distributions between two boreholes, derived from observed arrival times and amplitudes by simple back-projection tomography, reflect lithology and geological structure. The results indicate the potential usefulness of crosshole seismic imaging as a tool for rock mass characterization. (16 refs.)

121122 Local earthquakes on three-component seismographs: heterogeneity in the aftershock zone of El Asnam, Algeria (10.10.1980, M=7.3). A.Nercessian, M.Sapin, A.Hirn (Lab. d'Etude Geophys. de Structures Profondes, Univ. Pierre et Marie Curie, Paris, France), G.Wittlinger, M.Djeddi.
Geophys. Res. Lett. (USA), vol.10, no.8, p.69306 (1983).
Seismograms of aftershocks of the El Asnam earthquake recorded by three-component stations of a local array provide direct evidence of structural heterogeneity in the after shock zone. Inversion of arrival times for three dimensional velocity structure is thus needed for the relocation of hypocenters. These fall within a reduced depth interval from 6 to 12 km in the underthrust block. (8 refs.)

121123 Outer-rise earthquakes and seismic coupling. D.H.Christensen, L.J.Ruff (Dept. of Geological Sci., Univ. of Michigan, Ann Arbor, MI, USA).
Geophys. Res. Lett. (USA), vol.10, no.8, p.697-700 (1983).
Outer-rise earthquakes can be separated into two basic categories based on focal mechanism: compressional and tensional events reflecting compressional and tensional outer-rise stress regimes. A model is proposed that connects the stress regime in the outer-rise to the behavior of large subduction earthquakes and explains the focal mechanisms and both the temporal and spatial occurrence of outer-rise earthquakes. Compressional outer-rise events tend to occur oceanward of seismic gaps in seismically coupled subduction zones, or equivalently just prior to large subduction zone earthquakes. The compressional stress regime is probably caused by slip in adjacent subduction zone segments. There are two modes of occurrence for tensional outer-rise earthquakes depending on whether they occur in coupled or uncoupled subduction zones. (17 refs.)

121124 Walsh transforms in seismic-event detection. S.K.Fletcher (Systems Res. Div., Sandia Nat. Labs., Albuquerque, NM, USA).
IEEE Trans. Electromagn. Compat. (USA), vol.EMC-25, no.3, pt.2, p.367-9 (Aug. 1983).
Several approaches to detecting event signals in background noise are presented, and Walsh transforms are shown to be an efficient tool in implementing some of these. An experiment is reported in which four categories of detectors are represented, two using Walsh transforms in their implementation. The two Walsh-based detectors and one other have some capability of recognizing a spectral change in the data; these three outperformed a simple power detector in detecting low-level events. Of the three, the two Walsh-based ones have faster execution speed. Although these experimental results are for seismic signals and background, the usefulness of Walsh-transform-based detectors may extend to many other applications as well. (14 refs.)

121125 The physical model of the sources of deep-focus earthquakes. V.A.Kalinin, M.V.Rodkin (O.Yu. Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.8, p.555-61 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.8 (1982). [received: Sept. 1983]
A critical analysis is made of the existing models of the source of deep-focus earthquakes. A new source model is proposed which is based on superplastic properties of matter manifested in polymorphic transitions. The model satisfies all the characteristic features of deep seismicity and predicts the existence of a critical subduction velocity that determines the possibility of occurrence of deep-focus earthquakes in a subducting plate. (60 refs.)

121126 Forecast time stability of strong earthquake areas. I. Southeast Europe and Asia Minor. A.D.Gvishiani (O.Yu. Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.8 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.8, p.562-6 (1982). [received: Sept. 1983]
The necessary requirement of forecast time stability of strong earthquake sites is formulated, which postulates that a forecast should not be changed with admissible changes of input data. Mathematical propositions testing this requirement are proved. On this basis, time stability is established for the forecast of the location of epicenters of earthquakes with $M \geq 7.0$ in Southeast Europe and Asia Minor. (14 refs.)

121127 The development of travel time curves and time fields. N.N.Puzyrev (Inst. of Geology & Geophys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.743-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
The evolution of travel time curves and time fields in seismic prospecting and seismology is examined. The complex observation systems now in use require a broadened concept of the time field and the corresponding travel time curves. The author sets forth the theory of generalized time fields and the corresponding generalized travel time curves. According to this theory, the previously used representation of a time field with a fixed source is a specific case of a time field of the zero order. (10 refs.)

121128 The theory of kinematic interpretation of seismic prospecting data. S.V.Gol'din (Inst. of Geology & Geophys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.748-51 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
The development of the theory of kinematic interpretation of seismic prospecting data from the classic works of Riznichenko to the present (1980) is examined. (18 refs.)

121129 Relationships between velocity functions and travel time curves. M.E.Romanov, V.A.Sharafutdinov (Calculation Center, Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.752-3 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
Several new correlations between the velocity of a two-dimensionally-inhomogeneous medium and the corresponding travel-time curve are presented, as well as some integral correlations in kinematic seismic problems. Results are of interest for solutions of direct and inverse seismic problems. (1 ref.)

121130 Scattering and absorption of longitudinal seismic waves in the Earth's crust. M.V.Nevskii, A.V.Nikolayev, O.Yu.Riznichenko (O.Yu. Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.754-61 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
A new approach is developed for estimating losses due to scattering in longitudinal seismic waves, based on a study of fluctuations of the wave field of initial *P*-waves for given observations in the area of seismic groups. Independent estimates of scattering coefficients are obtained for longitudinal seismic waves in the crystalline crust in a frequency band of 1-50 Hz. The predominating role of scattering effects with relation to absorption is established. (17 refs.)

121131 Conditions at the rupture and spectra of the waves emitted by it. S.D.Vinogradov (O.Yu. Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.770-3 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
An experimental study is conducted of the spectra of waves from a shear fault with different roughnesses of the sides. The roughness of the fault plane is simulated by point adhesions with varying steps between adhesions. The shape of the pulses emitted and their spectrum depend substantially on the presence of adhesions and the step between them. The possibility is discussed of applying the findings of the study to interpretation of seismic data. (12 refs.)

121132 Model studies of the elastic wave field and residual strains caused by a shear fault. O.G.Shamina, A.A.Pavlov, R.V.Khanutina (O.Yu. Schmidt Earth Phys. Inst., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.774-80 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
Laboratory studies of a shear movement along an existing crack are described. A movement of overthrust type along a fault occurring under conditions of horizontal compression is modeled. The directivity of the longitudinal wave radiation is investigated, and the dynamic displacements and residual strains on the free surface are measured. The results are used for an interpretation of seismological data concerning the difference between the radiation of compression and tension waves. (7 refs.)

121133 Statistical analysis of the earthquakes of Europe. Z.Shenkova, V.Karnik (Inst. of Geophys., Acad. of Sci., Prague, Czechoslovakia).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.790-4 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
The statistical characteristics of the seismology of the European region are examined. The regularity of appearance of large events is well described by Poisson's process and by the theory of largest values; however, events of medium or small magnitude are modeled out better by a negative binomial expression. (16 refs.)

121134 Certain aspects of the seismic 'climate and weather' in the Transcarpathian region. R.S.Pronishin, B.G.Pustovitenko (S.I. Subbotin Geophys. Inst., Acad. of Sci., Ukrainian SSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.795-801 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
The long-term characteristics of the seismic climate in the region, their special features and the patterns of their variation in space and in time are considered. It is shown that there are differences in the seismic regime in different parts of the region and that the regime fluctuates in time. Certain patterns of development of the seismic process over a period of 200 years and during the last 20 years are established. An analysis is made of the seismic weather conditions during the period of preparation of strong earthquakes of the Transcarpathian region in 1979. (11 refs.)

121135 A comparative analysis of shakability graphs for certain objects in Tadzhikistan. R.S.Mikhaylova, K.M.Mirzoyev, T.A.Kinyapina, R.V.Dubinina (Inst. of Earthquake Resistant Construction & Seismology, Acad. of Sci., Tadzhik SSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.802-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
An attempt is made to choose the most reliable model of the focal seismicity of the territory of the Tadzhik SSR on the basis of a comparison of the calculated and observed shakabilities at a number of points. It is ascertained that at different points the observations agree in different ways with the results of calculations according to the adopted models of focal seismicity. (25 refs.)

121136 Seismic oscillations of the Earth's surface as a function of local conditions. A.A.Gvozdev, N.V.Zvolinskiy, A.N.Kovshov (Earth Phys. Inst., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.9, p.650-64 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.9 (1982). [received: Sept. 1983]
A survey is made of works dealing with the solution of problems concerning the effect of local conditions (the thickness of the loose soil layer, the relief, etc.) on oscillations of the Earth's surface during earthquakes. Attention is paid to the choice of the relations which describe the inelastic properties of the soil. (68 refs.)

121137 Time stability of a prediction of sites of strong earthquakes. II. The eastern part of Central Asia. A.D.Gvishiani, V.A.Gurvich (O.Yu. Schmidt Earth Phys. Inst., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.9, p.665-71 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.9 (1982). [received: Sept. 1983]
For pt.I see Izvestiya Akad. Nauk SSSR, Fizika Zemli, no.8, p.13-19 (1982). The prediction of sites where the epicentres of strong earthquakes may be located is treated as a pattern recognition problem. A special feature of this problem is that the partitioning of recognition objects into classes varies with the passage of time. This makes it possible to impose on a prediction the requirement of stability in time and thus greatly narrow the range of classifications claiming the role of a prediction. Within the framework of the general theory of pattern recognition a class of dynamic recognition problems is determined, the characteristic feature of which is the dependence of the classification of the objects on time. A definition of a stable prediction for a dynamic problem is given, and a stability criterion is derived for a prediction obtained by a VEC recognition algorithm. With the aid of these results the stability of a prediction of sites in the eastern part of Central Asia, where the epicenters of earthquakes with a magnitude $M \geq 6.5$ may be located, is demonstrated. (6 refs.)

121138 Effective conductivity of anisotropic medium with large number of cracks. V.I.Selyakov (Moscow Inst. of Engng. Phys., Moscow, USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.9, p.690-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.9 (1982). [received: Sept. 1983]
The plane problem of conductivity of an anisotropic medium with elliptical-shaped inclusions is considered in the case in which the concentration of the inclusions is not small. Analytical dependences of the effective conductivity of the medium on the concentration and length of the cracks are obtained. An increase in effective conductivity of the medium due to increase in length of the cracks alone without change in their volume is shown to be possible. (9 refs.)

121139 A very powerful earthquake in the Greater Caucasus Mountains, January 14, 1668. A.A.Nikonov (Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.9, p.713-25 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.9 (1982). [received: Sept. 1983]
Newly discovered sources are cited which describe the earthquake of 1668 in the Eastern Caucasus as the strongest of the known quakes. The dates of the earthquake and after shocks are identified more precisely, and uncertainties and contradictions in the catalogues concerning the earthquakes in the Caucasus from 1667 to 1670 are eliminated. The basic parameters of the earthquake are determined from equations of a macroseismic field, and include $M=8\pm0.2$ and $I_0\simeq10$. The probable tectonic position of the focus is also examined. The consequences of these conclusions are outlined for dividing the region into seismic districts and for estimating the potential seismic danger. (56 refs.)

121140 Strong earthquakes in the Eastern Caucasus: interpretation of historical data and analysis of geological situation. B.A.Borisov (O.Yu. Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.9, p.726-37 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.9 (1982). [received: Sept. 1983]
A.A. Nikonov's proposition that an earthquake of unprecedented force ($M\geq8$) took place in the eastern Caucasus on January 14, 1668, is discussed, and its historical and seismogeological basis is proved to be insufficient. The conditions for the occurrence of earthquakes in the Shemakha region are examined. The seismogeological situation in the Sheki-Kutkashen area where, according to Nikov's constructions, the focus of the 1668 earthquake should have been located, is analyzed. Theoretical considerations concerning the principal geological preconditions for the appearance of strong earthquakes in an alpine folded region are advanced. Based on a comparison of historical, seismological, and geological data, it is concluded that the maximum magnitude of earthquakes in the eastern Caucasus cannot be substantially greater than 6.5. (19 refs.)

121141 Possible seismic reflections from the downgoing Pacific plate, 275 kilometers arcward from the Eastern Aleutian Trench. M.A.Fisher, R.von Huene, G.L.Smith, T.R.Bruns (US Geological Survey, Menlo Park, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B7, p.5835-49 (10 July 1983).
Multichannel seismic reflection data collected near the southern Kenai Peninsula, Alaska, show deep events that could stem either from a linear diffractor or from a curved reflector. Whichever is the cause, it must be at a minimum depth of 12 km. If a linear diffractor causes the most obvious events, it strikes at a 60° angle across the surface trend of Mesozoic rocks. Thus the diffractor could be associated with a transverse tectonic boundary that, on the basis of other evidence, is thought to strike through the area of this study. Alternatively, these deep events could be reflections from rocks associated either with a detached piece of oceanic crust or with the downgoing Pacific plate. (41 refs.)

121142 Shear wave polarization anisotropy in the upper mantle beneath Honshu, Japan. M.Ando (Cooperative Inst. for Res. in Environmental Sci., Univ. of Colorado, Boulder, CO, USA), Y.Ishikawa, F.Yamazaki.
J. Geophys. Res. (USA), vol.88, no.B7, p.5850-64 (10 July 1983).
Shear wave polarization anisotropy in the wedge portion of the upper mantle between a subducting plate and the Earth's surface is investigated using three-component seismograms of intermediate depth and deep earthquakes recorded at 14 local stations in Honshu, Japan. The horizontal extent of the anisotropic area in the north is 50 km at depths of 50 to 150 km, perhaps prevalent in west Honshu. However, the depth of anisotropic material is not well constrained because of insufficient coverage of seismic ray paths and angles. The crack anisotropy and divine alignment in the mantle can explain the observations. (66 refs.)

121143 Seismic imaging of the Elberton granite, Inner Piedmont, Georgia, using COCORP southern Appalachian data. D.M.Jurdy (Dept. of Geological Sci., Northwestern Univ., Evanston, IL, USA), R.A.Phinney.
J. Geophys. Res. (USA), vol.88, no.B7, p.5865-73 (10 July 1983).
Seismic imaging of the Elberton granite in the Georgia Inner Piedmont was undertaken to define its shape and to determine its relation to the southern Appalachian thrust. The recent Consortium for Continental Reflection Profiling (COCORP) lines in the southern Appalachians suggest a major thrusting of a crystalline block over sediments, although the extent of this thrust is subject to interpretation. The fine-grained Elberton, of Late Devonian age, is the only major pluton crossed by the seismic traverse and is not well defined on the unmigrated common depth point (CDP) seismic sections. Migration by beam-forming reveals more detail. The identification of the granite base, along with the presence of the thrust-related reflectors beneath the pluton, suggests a prethrust or synthrust emplacement of the granite. However, tectonic interpretations of the Inner Piedmont based on the Elberton granite are severely limited by assumptions: that the pluton age corresponds to time of cooling, that the pluton is not fed by a narrow (seismically elusive) feeder, and that the thrust has not been reactivated after emplacement of the intrusive body. If all these assumptions hold, then the Late-Devonian age of the granite is the earliest possible time of thrusting. (24 refs.)

121144 Crustal and upper mantle structure of the northern and central Sierra Nevada. B.B.Mavko (US Geological Survey, Menlo Park, CA, USA), G.A.Thompson.
J. Geophys. Res. (USA), vol.88, no.B7, p.5874-92 (10 July 1983).
Teleseismic data were recorded within the Sierra Nevada to look for lateral variations in the upper mantle. After correcting the P residual data for crustal and topographic effects, there is still a variation of as much as 0.5-0.6 s from the north end of the Sierra Nevada to Mono Lake, located east of the central part of the range. In addition, there are significant variations in travel time patterns, depending on the azimuth of wave arrivals. Two simple modeling approaches have been used to infer the upper mantle velocity structure for the observed variations in travel time. (53 refs.)

121145 Nonlinear strain buildup and the earthquake cycle on the San Andreas fault. W.Thatcher (US Geological Survey, Menlo Park, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B7, p.5893-902 (10 July 1983).
Two contrasting models of the earthquake deformation cycle on strike slip faults predict signifidant temporal declines in shear strain rate near the fault, accompanied by a progressive broadening of the zone of deformation adjacent to it. In the thin lithosphere model, transient deformation results from flow in the asthenosphere due to stress relaxation following faulting through most or all of the lithosphere. For an Earth model with a thick elastic lithosphere (plate thickness$\gg$depth of seismic slip), transient motions are due to postearthquake aseismic slip below the coseismic fault plane. Data from the San Andreas fault indicate a long-term temporal decrease in strain rate that persists for at least 30 years and may extend throughout the entire earthquake cycle. Observations support a cycle-long rate decrease and a temporal spreading of the deformation profile only if movement cycles on the northern and southern locked sections of the fault are basically similar. If so, the usually lower strain rates and broader deformation zone currently observed in the southern San Andreas represent a later evolutionary stage of the northern locked section, where the great earthquake is a more recent occurrence. No sufficiently strong constraints exist to decide between the thin and thick lithosphere models. (40 refs.)

121146 Age dependence of oceanic intraplate seismicity and implications for lithospheric evolution. D.A.Wiens, S.Stein (Dept. of Geological Sci., Northwestern Univ., Evanston, IL, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6455-68 (10 Aug. 1983).
The depths for 16 oceanic intraplate earthquakes have been determined using body wave modeling. A data set composed of these and 11 other well-constrained depths shows that the maximum depth of seismicity deepens with increasing lithospheric age and appears to be bounded by a 700°-800°C isotherm. The maximum depth to which intraplate earthquakes occur is approximately equal to the flexural elastic thickness but much less than the siesmic thickness from surface wave dispersion. The maximum faulting depth is consistent with the predictions of rapid weakening at high temperatures for dry olivine rheologies determined by experimental rock mechanics. Both the number of earthquakes and the cumulative siesmic moment decrease with lithospheric age. (88 refs.)

121147 A method for modeling reflection data from media with lateral velocity changes. J.A.Carter, L.N.Frazer (Hawaii Inst. of Geophys., Univ. of Hawaii, Honolulu, HI, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6469-76 (10 Aug. 1983).
A new method of modeling zero offset reflection data accommodates both vertical and lateral velocity variations and allows continuous changes in reflectivity throughout the section. Each point in the subsurface is considered a point scatterer, and the energy at each point is distributed over the diffraction curve that would be observed if it were the only scatterer in the subsurface. When the velocity varies only with depth, the diffraction curves are relatively simple to determine. Computing the diffraction curves when there are lateral velocity variations, however, requires extensive ray tracing. The authors' method avoids the extensive ray trace by approximating the exact diffraction curves with perturbed diffraction curves computed for a model in which the velocity varies only with depth. The slowness (reciprocal velocity) function is written as the sum of two functions: the first is large and depends only on depth and the other is small and varies both with depth and position along the line. (26 refs.)

121148 The 1979 Homestead Valley earthquake sequence, California: control of aftershocks and postseismic deformation. R.S.Stein, M.Lisowski (US Geological Survey, Menlo Park, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6477-90 (10 Aug. 1983).
The coseismic slip and geometry of the March 15, 1979, Homestead Valley, California, earthquake sequence are well constrained by precise horizontal and vertical geodetic observations and by data from a dense local seismic network. These observations indicate 0.52 ± 0.10 m of right-lateral slip and 0.17 ± 0.04 m of reverse slip on a buried vertical 6-km-long and 5-km-deep fault and yield a mean static stress drop of 7.2 ± 1.3 MPa. The largest shock had $M_s=5.6$. Observations of the ground rupture revealed up to 0.1 m of right-lateral slip on two mapped faults that are subparallel to the modeled seismic slip plane. In the 1.9 years since the earthquakes, geodetic network displacements indicate that an additional 60 ± 10 mm of postseismic creep took place. The rate of shear strain was anomalously high compared to its preearthquake value and cannot be explained by postseismic slip on the seismic fault but rather indicates that broadscale release of strain followed the earthquake sequence. (27 refs.)

121149 The influence of shear modulus and damping ratio on amplification spectrum and response spectra. G.Marmureanu, D.Bratosin, Fl.St.Balan, E.Cojocaru (Center of Earth Phys. & Seismology, Bucharest, Rumania).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.2, p.175-84 (March-April 1983). [received: Sept. 1983]
Summarizes the results obtained by the authors regarding the influence of shear modulus and damping ratio on site amplification spectrum and response spectra. The authors pointed out there is a strong nonlinear dependence of shear modulus and damping ratio with dynamic shear strain. All tests were performed on undisturbed specimens (of clay, sand and marl), isotropically consolidated so as to correspond to the situ mean principal effective stress. The equipment used was the Drnevich Long-tor resonant column apparatus from Center of Earth Physics and Seismology, Bucharest. (4 refs.)

121150 On the methods of spectral characterisation of random nonstationary processes with application to the study of Earth tremors. I. A.Preumont.
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.2, p.211-23 (March-April 1983). In French. [received: Sept. 1983]
After discussing the need to consider seismic accelerograms as random nonstationary processes some nonstationary spectral characterisations are reviewed from density of instantaneous spectral power as a direct prolongation of the spectral density power idea for a stationary process (by Fourier transform of autocorrelation) but having no physical significance, to Mark's physical spectrum. This latter seems the tool best adapted to describe the repartition of energy in the domain (time frequency). This is the principle of uncertainty linking the resolutions obtainable. Some illustrations linked to the seismic domain are provided. (no refs.) *J.S.*

121151 On the methods of spectral characterisation of random nonstationary processes with application to Earth-tremor studies. II. A.Preumont.
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.3, p.311-16 (May-June 1983). In French. [received: Sept. 1983]
For pt.I see ibid., vol.28, no.2, p.211-23 (1983). Continues the analysis of part I, from the Fourier transform and leading to the response of a narrow-band filter and of a conventional lightly-damped seismograph to a feebly stationary excitation. (no refs.) *J.S.*

121152 Dilatancy in brittle rocks. C.Radu (Center of Earth Phys. & Seismology, Bucharest-Magurele, Rumania), I.Rugina, G.Winter, V.Winter.
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.4, p.447-50 (July-Aug. 1983).
Dilatency in brittle rocks was studied by means of the strain-gauge method. Dilatancy appears rather in rocks with higher porosity than in more compact ones, presenting also a higher magnitude for the first case. Earthquake precursors depending on increasing strain may occur more frequently in rocks with higher porosity, allowing for easier investigation. (4 refs.)

121153 On the methods of spectral characterisation of nonstationary random processes with application to the study of earth tremors. III. A.Preumont (Belgonucleaire SA, Bruxelles, Belgium).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.4, p.367-85 (July-Aug. 1983). In French.
Reviews Mark's (1970) concept of the physical spectrum as probably the best tool for obtaining a decomposition of the total energy of any such process in the time and frequency domain. Time frequency duality is discussed, and its connections with the response of a battery of narrow band-pass filters and with the instantaneous power spectral density are worked out from integral equations. Examples of use in the seismic study of structures are illustrated by an acelerogram with comptuer printouts of its physical spectrum, and graphs of the evolution of the integral for three nominal durations of the Gaussian window and two samples of the excitation process. (26 refs.) *M.B.D.*

121154 Method and results of determining the absorption of seismic waves in the central part of the Baikal Rift Zone. A.A.Dergachev (Inst. of Geology & Geophys., Acad. of Sci., Novosibirsk, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.6, p.83-90 (1982). Translation of: *Geol. & Geofiz. (USSR),* vol.23, no.6, p.94-101 (1982). [received: Oct. 1983]
A new method is proposed for determining the seismic Q, the basis of which is the central frequency of the seismic wave spectra. The method is applied to seismological observations in the Baikal Rift Zone and data are obtained on the spatial variations of the parameter Q: the upper parts of negative morpho structures of the Earth's crust (rift valleys) have a low Q value, whereas positive morpho structures have a high value; a high-Q layer was detected in the crustal section at a depth fo 15-20 km. (19 refs.)

121155 Interpretation of data of multiple systems of observations of refracted waves when studying the basement of the West Siberian Platform. V.D..Suvorov, V.N.Sergeev (Geology & Geophys. Inst., Acad. of Sci., Novosibirsk, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.6, p.91-7 (1982). Translation of: *Geol. & Geofiz. (USSR),* vol.23, no.6, p.102-9 (1982). [received: Oct. 1983]
A method is proposed for analyzing the processing refracted wave data obtained from multiple observation systems based on transformation of the observed travel-time curves into a time section t_0 and distribution of boundary velocities. The method permits solving the problem of separating waves in the first arrivals. If necessary, the depth section is refined by the method of conjugate points determined by successive approximations. The standard procedure of the operations permits processing the greater part of the data on a computer. (10 refs.)

121156 The dendrochronological dating of seismogenic ruptures in the Stanovoi highland. V.V.Ruzhich, V.A.San'kov, Yu.I.Dneprovskii (Inst. for Study of the Earth's Crust, Acad. of Sci., Irkutsk, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.8, p.57-63 (1982). Translation of: *Geol. & Geofiz. (USSR),* vol.23, no.8, p.62-9 (1982). [received: Oct. 1983]
The use of improved methods of dendrochronology in dating seismogenic structures formed in the historical past or at the present time in the Stanovoi highland has yielded important information on the space and time aspects of the local seismic region. The method described proved to be highly successful in the pleistoseismic zone of the catastrophic Muya earthquake of 1957, and has been useful in obtaining information on other older seismogenic structures in the northeast of the Baikal rift zone. The potential for a wider application of the dendrochronological method in seismotectonics is considered. (12 refs.)

121157 Calculation of the scalar wave field scattered by a sphere and an analysis of the images. V.G.Khaidukov (Inst. of Geology & Geophys., Acad. of Sci., Novosibirsk, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.8, p.96-104 (1982). Translation of: *Geol. & Geofiz. (USSR),* vol.23, no.8, p.104-14 (1982). [received: Oct. 1983]
A numerical method of the exact solution of the problem of diffraction of an acoustic spherical wave on a spherical inhomogeneity is examined. The possibilities of two methods of visualization of the medium based on an inverted continuation of the pulsed and stationary fields are examined for the sample of the solution of this problem. (11 refs.)

121158 Improvement and testing of a variant of the seismoholographic Kirchhoff transformation. S.A.Vasil'ev, V.V.Perekhvatov (All Union Res. Inst. of Geophys., Moscow, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.8, p.128-32 (1982). Translation of: *Geol. & Geofiz. (USSR),* vol.23, no.8, p.139-44 (1982). [received: Oct. 1983]
A regularized algorithm for seismoholographic Kirchhoff transformation of CDP time sections into a dynamic image of the medium is proposed. The regularization method is substantiated and results of testing the algorithm on model and field sections are presented. (8 refs.)

On a problem of structural dynamics ....See Entry 118393

Shear wave observations in the region north of the San Francisco Bay ....See Entry 121160

Evaluation of the parameters of a medium in constructing a block model by seismic methods ....See Entry 121165

Seismological evidence for shallow crystalline basement in the Southern Uplands of Scotland ....See Entry 121175

Strength of the Earth's crust and seismic efficiency of earthquake foci ....See Entry 121178

Characteristics of the relation between density and longitudinal and transverse wave velocities in rocks ....See Entry 121179

Geometry of magma bodies beneath Long Valley, California determined from anomalous earthquake signals ....See Entry 121180

Dynamic stress drops of moderate earthquakes of the Eastern Aleutians and their relation to a great earthquake ....See Entry 121186

Mechanism of earthquake foci and stressed state of Iranian plate ....See Entry 121192

The spatial patterns of the aftershock strain of the focal region of a strong earthquake ....See Entry 121193

Seismotectonic strain of the crust of the southern part of central Asia ....See Entry 121194

Problems in study of seismotectonic deformation of rock masses ....See Entry 121195

Seismic flow of rock masses in the Caucasus ....See Entry 121196

Some basic regularities in the seismotectonic deformation of the Kuril-Kamchatka region over 1929-1973 ....See Entry 121197

Precursors of the destruction of a large rock sample ....See Entry 121217

Ground failure along the New River caused by the October 1979 Imperial Valley earthquake sequence ....See Entry 121246

Digitization noise and accelerograph pen offset associated with Japanese accelerograms ....See Entry 121383

Remote acoustic classification of marine sediments with application to offshore Newfoundland ....See Entry 121385

Homomorphic deconvolution of potential field data in one and two dimensions ....See Entry 121386

A method for the determination of absorption for refracted waves ....See Entry 121393

The correction for sediment loading on the seafloor ....See Entry 121396

The solution of seismic interpretation problems using the finite element method ....See Entry 121406

Digital filtering of the data of sea-level survey [for earthquake prediction] ....See Entry 121412

91.35 EARTH'S INTERIOR STRUCTURE AND PROPERTIES

121159 The carbonate-silicate geochemical cycle and its effect on atmospheric carbon dioxide over the past 100 million years. R.A.Berner (Dept. of Geology & Geophys., Yale Univ., New Haven, CT, USA), A.C.Lasaga, R.M.Garrels.
Am. J. Sci. (USA), vol.283, no.7, p.641-83 (Sept. 1983).
A computer model has been constructed that considers the effects on the CO_2 concentration in the atmosphere of continental weathering, biogenic precipitation of $CaCO_3$, seawater-volcanic rock reactions, and the metamorphic-magmatic decarbonation of calcite and dolomite. Rate expressions are derived for all the transfer reactions. These expressions are constructed so as to reflect changes over the past 100 Myr in the rate-controlling parameters. It is found that the atmospehric CO_2 concentration is very sensitive to changes in the seafloor spreading rate and the continental land area. The results indicate, therefore, that plate tectonics largely governs atmospheric CO_2 concentrations and, thereby, the climate of the Earth. (63 refs.)

121160 Shear wave observations in the region north of the San Francisco Bay. A.R.Levander, H.Quin, R.L.Kovach (Dept. of Geophys., Stanford Univ., Stanford, CA, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1031-9 (Aug. 1983).
Examines local earthquake shear wave travel times from a four-station, intermediate-period, three-component seismograph array located in the Coast Ranges north of San Francisco Bay. The preferred interpretation of the data indicates an upper crustal layer with a shear velocity of 3.05 ± 0.10 km/sec over a lower crustal layer having a shear velocity of 3.87 ± 0.15 km/sec. The authors estimate the thickness of the upper crustal layer to be 13.0 ± 3.0 km. The shear velocity of the lower crustal layer, 3.87 km/sec, is higher than crustal shear velocities reported elsewhere in the Coast Ranges and corresponds to the shear velocity of layer three of the oceanic crust. (24 refs.)

121161 The geology and structural history of the Cape Ray Fault Zone in southwestern Newfoundland. D.H.C.Wilton (Dept. of Earth Sci., Memorial Univ. of Newfoundland, St. John's, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.7, p.1119-33 (July 1983).
Structural studies within the Cape Ray Fault Zone indicate that three tectonic events (D1 to D3) have deformed all regional lithologic units. These lithologies are distributed as a tonalitic terrain (intrusive into ophiolitic remnants) to the northwest, a central volcanic-sedimentary terrain, and a staurolite-kyanite gneiss terrain to the southeast. D1 produced the dominant northeasterly striking planar fabrics in the host rocks that are axial planar to isoclinal folds. The fold axes parallel a synkinematic mineral elongation lineation. D2 formed open asymmetrical folds with curvilinear fold axes and local crenulation cleavage. The D3 event produced local conjugate kink folds. Radiometric dates on deformed plutons indicate these deformational events were post-369 ± 12 Ma (post-Middle Devonian) and pre-352 ± 6 Ma (pre-Late Carboniferous). The present work indicates that the deformational events that produced the fault zone overprinted all regional lithologies in a similar manner and that the delineating mylonites were the products of ductile simple shear due to intense localized deformation. (27 refs.)

121162 Bimodal volcanism in Archean greenstone belts exemplified by greywacke composition, Lake Superior Park, Ontario. L.D.Ayres (Dept. of Earth Sci., Univ. of Manitoba, Winnipeg, Manitoba, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.7, p.1168-95 (July 1983).
In the Archean Gamitagama Lake greenstone belt, a metagreywacke-metasilstone formation at least 3.6 km thick largely had an easily eroded, unconsolidated, subaerial, pyroclastic felsic volcanic provenance. The remains of this provenance are now represented by a 0-600 m thick felsic formation sandwiched between mafic flow formations in an adjacent and laterally equivalent 4.5 km thick metavolcanic sequence. The felsic formation includes flows plus various pyroelastic units including crystal-rich ash-flow tuff. Volcanism, erosion, transportation, and sedimentation appear to have been essentially contemporaneous with subaerially erupted ash that was being trans-

ported rapidly by rivers to the sedimentary basin where it was deposited in a submarine fan. (97 refs.)

121163 Rb-Sr and U-Pb dating of bentonites. H.Baadsgaard, J.F.Lerbekmo (Dept. of Geology, Univ. of Alberta, Edmonton, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.8, p.1282-90 (Aug. 1983).
The authors describe measurements of a 15 cm bentonite in the Z coal (Cretaceous-Tertiary boundary) in E Montana, and of the Ordovician Kinnekulle A_1 bentonite of SW Sweden. U-Pb analyses of zircons from the Z coal bentonite yielded an age of 63.9 Myr from a concordia diagram. Biotite fractions from both bentonites were analysed for Rb-Sr dating. The analyses showed a departure from a linear isochron, when more than about 30% of the original Rb had been lost, but biotites that retained more than 70% of their original Rb gave usable Rb-Sr data. The ages and initial $^{87}Sr/^{86}Sr$ ratios of the Z coal and Kinnekulle A_1 bentonites were 63.7 Myr and 0.7061, and 447 Myr and 0.7094, respectively. (20 refs.)

121164 Continental hypsography. C.G.A.Harrison, K.J.Miskell, G.W.Brass, E.S.Saltzman, J.L.Sloan,II. (Rosenstiel School of Marine & Atmospheric Sci., Univ. of Miami, Coral Gables, FL, USA).
Tectonics (USA), vol.2, no.4, p.357-77 (Aug. 1983).
Average continental elevations for 1-degree-square areas have been used to construct detailed continental hypsographic curves. Data are given for each 0.1 km interval of elevation. The availability of the data on tapes allowed calculations of the average elevation of each continent, an important normalizing parameter when comparing continental hypsographic curves, and enabled the effects of the continental shelves to be added on. It has also allowed recalculation of the amount of continent antipodal to continent and production of a map of the world showing these areas. The detailed curves and the amounts of continental flooding during the Neozoic have been used to derive records of sea level variation necessary to explain the amount of flooding for each continent through time. (28 refs.)

121165 Evaluation of the parameters of a medium in constructing a block model by seismic methods. I.A.Sanina (O.Yu. Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.8, p.581-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.8 (1982). [received: Sept. 1983]
By using an assembly of structural functions, a method is investigated (with special reference to data of registration of P-waves from remote earthquakes by short-period instruments of the NORSAR array) for evaluation of those parameters of the medium that are necessary for constructing deterministic models. (10 refs.)

121166 On a model of the upper layers of the Earth's crust. M.A.Sadovskiy, V.A.Denshchikov, V.N.Kondrat'yev, A.N.Romashov, V.M.Chubarov (O.Yu. Schmidt Earth Phys. Inst., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.9, p.645-9 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.9 (1982). [received: Sept. 1983]
A two-layer model of the upper layers of the Earth's Crust is considered, which is based on generally admitted facts concerning the block structure and concerning the presence of excess stresses in these layers. A study is made of the simplest variant of the deformation and destruction of the model. A qualitative comparison is made between the results of the model studies and certain data concerning the behavior of real rock masses. (12 refs.)

121167 Generation of arc basalt magmas and thermal structure of the mantle wedge in subduction zones. Y.Tatsumi (Earthquake Res. Inst., Univ. of Tokyo, Tokyo, Japan), M.Sakuyama, H.Fukuyama, I.Kushiro.
J. Geophys. Res. (USA), vol.88, no.B7, p.5815-25 (10 July 1983).
The chemical compositions of primary magmas of olivine tholeiite (OTB), high-alumina basalt (HAB), and alkali olivine basalt (AOB) are obtained by the olivine maximum fractionation model for Quaternary magnesian basalts from the Northeastern Japan arc. These basalts are assumed to have fractionated only olivine crystals before eruption. The melting phase relations for three primary basalt compositions have been determined under both anhydrous and water-undersaturated conditions. The mineral coexistences for these rock melts is studied at different temperatures. The water content of the magma is considered. Based on these estimates and the experimental results, the AOB, HAB, and OTB magmas are suggested to segregate from the mantle at about 1320°C and at 23, 17, and 11 kbar, respectively. As the temperatures at the segregation of the magmas appear to be too high for a stable mantle geotherm, the mantle diapir is the most probable mechanism for the magma production in a subduction zone. Considering the heat of formation of melt in the diapir, the region with temperatures higher than 1400°C has to be present in the mantle wedge. (71 refs.)

121168 Surface deformation associated with a dipping hydrofracture. P.M.Davis (Dept. of Earth & Space Sci., Univ. of California, Los Angeles, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B7, p.5826-34 (10 July 1983).
Crustal deformation associated with hydrofracture is modeled by a dipping rectangular dislocation beneath the surface of an elastic half space. The Burger's vector is taken normal to the rectangular surface. Analytical expressions for vertical displacements are obtained from integration of Volterra's equation by using Mindlin's point force solutions for the elastic halfspace. In the limits of O° and 90° dip, the results agree with those obtained by Maruyama (1964) for Poisson's ratio 0.25. Expressions for arbitrary Poisson's ratio are given. For elongate dislocations the displacement field agrees with curves given by Pollard and Holzhausen (1979) for two-dimensional, near surface fractures at various dips. The displacement due to a square dislocation is studied. (34 refs.)

121169 Calculated temperatures in overthrust terrains and possible combinations of heat sources responsible for the Tertiary granites in the Greater Himalaya. P.Molnar (Dept. of Earth & Planetary Sci., MIT, Cambridge, MA, USA), Wang-Ping Chen, E.Padovani.
J. Geophys. Res. (USA), vol.88, no.B8, p.6415-29 (10 Aug. 1983).
There are three obvious sources of heat that affect the temperature in a region of thrust faulting: heat supplied from below the lower thrust plate, radiogenic heating within the crust of both the upper and, especially, the lower plates, and frictional heating along the fault. The authors assume that heat is conducted primarily in the vertical direction and that solutions to the one-dimensional, time-dependent heat conduction equation can be used to describe the temperature field in overthrust zones. The effects of these three sources of heating can be isolated from one another, treated separately, and then combined in ratio proportional to various assumed rates of heating provided by each. Calculations for a range of possible combinations of heat sources are then used that may have caused two-mica granites of late Tertiary age in the Greater Himalaya. (53 refs.)

121170 Average regional strain due to slip on numerous faults of different orientations. P.Molnar (Dept. of Earth & Planetary Sci., MIT, Cambridge, MA, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6430-2 (10 Aug. 1983).
If a region is cut by faults with different orientations and if the faults intersect the boundaries of the region of interest, then the average finite (rotational) strain, $\epsilon_{ij}=\partial u_i/\partial X_j$, is given by $\epsilon_{ij}=\Sigma\ M^*_{ij}/\mu V$ where μ is the shear modulus, V is the volume of the region, and $\Sigma\ M^*_{ij}$ represents the sum of asymmetric moment tensors, M^*_{ij}. For each fault, $M^*_{ij}=M_0\hat{u}\hat{n}$, where M_0 is the scalar siesmic moment and $\hat{u}$ and $\hat{n}$ are the unit vectors parallel to the slip vector and perpendicular to the fault plane. This result is applicable when the average regional strain occurs primarily by displacements of essentially rigid blocks that together compose the region of interest and hence when both elastic strains and inelastic strains due to folding and bending are small. (4 refs.)

121171 Rare gases from the undepleted mantle?. D.E.Fisher (Rosenstiel School of Marine & Atmospheric Sci., Univ. of Miami, Miami, FL, USA).
Nature (GB), vol.305, no.5932, p.298-300 (22 Sept. 1983).
If the concept of a depleted/undepleted mantle system is valid, rare gas isotopic composition and abundances should be different in continental and plume areas fed from the undepleted mantle than in oceanic glasses fed from a depleted mantle. Ultramific inclusions in basalt have been studied in attempts to find examples of undepleted mantle trapped gases. The author has measured ^4He, ^{40}Ar and ^{36}Ar abundances in two Hawaiian ultramific nodules, and finds clear evidence of incomplete retention of mantle gases plus significant atmospheric contamination. Comparison with the previously measured phenocrysts indicates the prevalence of these complications in all such ultramafic samples. (15 refs.)

121172 Metamorphic and tectonic evolution of granulites, Arunta Block, central Australia. R.G.Warren (Bur. of Mineral Resources, Geology & Geophys., Canberra, Australia).
Nature (GB), vol.305, no.5932, p.300-3 (22 Sept. 1983).
Petrographical and chemical evidence presented indicate a prolonged metamorphic evolution of the granulite terrain in the northern Strangways Range, Arunta Block, central Australia, beginning with migmatization, followed by dry granulite metamorphism at high temperatures (T) and moderate pressures (P) (estimated at 850-920°C, 8 ± 1 kbar^1). This occurred at ~1800 Myr, very shortly after deposition of the protolith, a bimodal volcanic suite and associated sediments. Granulite metamorphism was followed by isobaric cooling, during which there was an episode of pervasive but partial hydration. A tensional, rift-like regime best describes the geological environment in which the protolith formed, was deeply buried, metamorphosed with high heat flow, and then remained in isostatic equilibrium. (26 refs.)

121173 The Mesozoic marginal basin of central Peru. M.P.Atherton, W.S.Pitcher, V.Warden (Jane Herdman Labs. of Geology, Univ. of Liverpool, Liverpool, England).
Nature (GB), vol.305, no.5932, p.303-6 (22 Sept. 1983).
The west Peruvian Trough extends some 1300 km from north of Trujillo to about 150 km short of Arequipa. It received upwards of 9000 m of material during the Mesozoic and within the Cretaceous rocks there is a well defined west-to-east facies change whereby thick, volcaniclastic turbidites and pillow lavas thin eastward to be replaced by a mixed clastic shelf sequence (the 'miogeosyncline'). The authors report chemical analyses of the volcanic rocks and data on the association of cherts, volcaniclastic turbidites, dyke and sill complexes and large gabbro masses as well as geophysical evidence which suggests that the 'eugeosyncline' is an extensional marginal basin similar to that seen in rocks of the same age in Southern Chile. (33 refs.)

121174 Effect of pressure on rare earth element partition coefficients in common magmas. T.H.Green, N.J.Pearson (School of Earth Sci., Macquarie Univ., North Ryde, New South Wales, Australia).
Nature (GB), vol.305, no.5933, p.414-16 (29 Sept. 1983).
Describes a series of experiments in which the role of pressure was isolated from that of temperature and melt composition (or melt structure). The authors are also able to demonstrate a systematic increase in La, Sm, Ho and Lu partition coefficients for sphene/silicate liquid and clinopyroxene/silicate liquid as pressure increases from 7.5 to 30 kbar. (19 refs.)

121175 Seismological evidence for shallow crystalline basement in the Southern Uplands of Scotland. J.Hall, D.W.Powell (Dept. of Geology, Univ. of Glasgow, Glasgow, Scotland), M.R.Warner, Z.H.M.El-Isa, O.Adesanya, B.J.Bluck.
Nature (GB), vol.305, no.5933, p.418-20 (29 Sept. 1983).
New evidence is presented, and old data reappraised, to indicate that the Southern Uplands of Scotland contain crystalline rocks of continental affinity at shallow depth (1-5 km) in at least two zones roughly parallel to the Caledonoid strike. This is in contrast with earlier interpretations (especially of the LISPB) which suggested that the lack of such rocks implied a major discontinuity across the Caledonides near the Southern Uplands Fault. The new interpretations suggest that basement indistinguishable seismologically from that below the Midland Valley continues 15-20 km southwards below the Southern Uplands, and that another such crustal block underlies the Eskdalemuir seismological array further to the south. The existence of such blocks radically affects plate tectonic reconstructions of the Caledonides especially the margins of the Iapetus Ocean. Only drilling is likely to show whether the contact between basement and the overlying Lower Palaeozoic greywackes and shales is structural, igneous or, least likely, simple overstep. (21 refs.)

121176 Lithospheric stretching and North Sea Jurassic clastic sourcelands. M.R.Leeder (Dept. of Earth Sci., Univ. of Leeds, Leeds, England).
Nature (GB), vol.305, no.5934, p.510-14 (6 Oct. 1983).
Uniform lithospheric stretching cannot explain three important aspects of North Sea basin evolution: namely (1) the rapid growth of Middle Jurassic uplands from which were liberated major fluvial-deltaic clastic wedges now forming the main hydrocarbon reservoirs; (2) the occurrence of basin centre upwarp and basaltic volcanism; and (3), widespread and significant (~1 km) subsidence outside the area of demonstrable crustal thinning. The author presents the suggestion that a combination of nonuniform stretching and lithospheric flexuring accounts for these 'fine-tuning' effects of the uniform stretching model with magnitudes close to those demanded by independent geological evidence. (29 refs.)

121177 Confirmation of the Carolina slate belt as an exotic terrane. D.T.Secor,Jr., S.L.Samson, A.W.Snoke (Dept. of Geology, Univ. of South Carolina, Columbia, SC, USA), A.R.Palmer.
Science (USA), vol.221, no.4611, p.649-51 (12 Aug. 1983).
An assemblage of Middle Cambrian Atlantic faunal province trilobites has been found in the rocks of the Carolina slate belt near Batesburg, South Carolina. Geologic and paleomagnetic data suggest that the Carolina slate belt and the adacent Charlotte belt constitute an exotic terrane that was accreted to North America in early to middle Paleozoic time. (25 refs.)

121178 Strength of the Earth's crust and seismic efficiency of earthquake foci. N.D.Zhalkovskii (Inst. of Geology & Geophys., Acad. of Sci., Novosibirsk, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.8, p.105-12 (1982). Translation of: *Geol. & Geofiz. (USSR)*, vol.23, no.8, p.114-22 (1982). [received: Oct. 1983]
The relationships between the seismic moment and the magnitude, energy, fault dimensions, and certain other parameters of the earthquake focus are refined on the basis of the literature data. It is shown that the ratio of the seismic energy to the seismic moment does not depend on the power of the earthquake and amounts to about 10^{-2}. The apparent stress and stress drop on the fault are also independent of the power of the earthquake and are characterized on average by values of 3×10^3 and 8 bars, respectively. These results lead to the conclusion that the strength of the Earth's crust should be at least 3×10^3 bars and the seismic efficiency of the earthquake focus at least 0.5. (52 refs.)

121179 Characteristics of the relation between density and longitudinal and transverse wave velocities in rocks. A.L.Aleinikov, A.M.Tiunova, N.I.Khalevin (Inst. of Geophys., Acad. of Sci., Sverdlovsk, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.8, p.123-7 (1982). Translation of: *Geol. & Geofiz. (USSR)*, vol.23, no.8, p.134-9 (1982). [received: Oct. 1983]
The relation between density and longitudinal and transverse wave velocities is analyzed. It is shown that their combined use greatly increases the accuracy of determining the density of rocks in the Earth's crust. (14 refs.)

Modelling of vertical crustal movements by means of collocation ...... See Entry 121090

New paleomagnetic data for the Triassic Guichon batholith of south-central British Columbia and their bearing on Terrane I tectonics .... See Entry 121094

Effect of deep fractures on the resolution capacity of magnetotelluric sounding ...... See Entry 121099

Palaeomagnetism of Lower Cretaceous tuffs from Yukon-Kuskokwim delta region, western Alaska ...... See Entry 121104

A specific barrier model for the quantitative description of inhomogeneous faulting and the prediction of strong ground motion. II. Applications of the model ...... See Entry 121108

Seismicity in the St. Elias region of northwestern Canada and southeastern Alaska ...... See Entry 121115

Crosshole seismology and seismic imaging in crystalline rocks ...... See Entry 121121

Local earthquakes on three-component seismographs: heterogeneity in the aftershock zone of El Asnam, Algeria (10.10.1980, M = 7.3) ...... See Entry 121122

The physical model of the sources of deep-focus earthquakes ...... See Entry 121125

Scattering and absorption of longitudinal seismic waves in the Earth's crust ...... See Entry 121130

Effective conductivity of anisotropic medium with large number of cracks ...... See Entry 121138

Possible seismic reflections from the downgoing Pacific plate, 275 kilometers arcward from the Eastern Aleutian Trench ...... See Entry 121141

Shear wave polarization anisotropy in the upper mantle beneath Honshu, Japan ...... See Entry 121142

Seismic imaging of the Elberton granite, Inner Piedmont, Georgia, using COCORP southern Appalachian data ...... See Entry 121143

Crustal and upper mantle structure of the northern and central Sierra Nevada ...... See Entry 121144

Age dependence of oceanic intraplate seismicity and implications for lithospheric evolution ...... See Entry 121146

Method and results of determining the absorption of seismic waves in the central part of the Baikal Rift Zone ...... See Entry 121154

Interpretation of data of multiple systems of observations of refracted waves when studying the basement of the West Siberian Platform .. See Entry 121155

The dendrochronological dating of seismogenic ruptures in the Stanovoi highland ...... See Entry 121156

Geometry of magma bodies beneath Long Valley, California determined from anomalous earthquake signals ...... See Entry 121180

Determination of timing of volcanic events by secular variation and thermal modeling ...... See Entry 121181

Effects of melt density on magma mixing in calc-alkaline series lavas ...... See Entry 121183

The dynamics of the melting of lithosphere rocks and the lateral inhomogeneities of the magmatism of island arcs ...... See Entry 121185

Dynamic stress drops of moderate earthquakes of the Eastern Aleutians and their relation to a great earthquake ...... See Entry 121186

Geodetic measurements of postseismic crustal deformation following the 1979 Imperial Valley earthquake, California ...... See Entry 121187

Kinematic history of the Narragansett Basin, Massachusetts, and Rhode Island: constraints on Late Paleozoic plate reconstructions ... See Entry 121188

Normal faulting, block tilting, and decollement in a stretched crust ...... See Entry 121189

Influence of plate subduction on isostatic compensation in northern California ...... See Entry 121190

The mean life of continents: estimates of continent recycling rates from Nd and Hf isotopic data and implications for mantle structure ... See Entry 121191

Mechanism of earthquake foci and stressed state of Iranian plate ...... See Entry 121192

The spatial patterns of the aftershock strain of the focal region of a strong earthquake ...... See Entry 121193

Seismotectonic strain of the crust of the southern part of central Asia ...... See Entry 121194

Problems in study of seismotectonic deformation of rock masses ...... See Entry 121195

Seismic flow of rock masses in the Caucasus ...... See Entry 121196

Some basic regularities in the seismotectonic deformation of the Kuril-Kamchatka region over 1929-1973 ...... See Entry 121197

Convection in a two-layer mantle with a strongly temperature-dependent viscosity ...... See Entry 121199

Gloria observations of the propagating rift at 95.5°W on the Cocos-Nazca spreading center ...... See Entry 121200

Rotation of the Peruvian Block from palaeomagnetic studies of the Central Andes ...... See Entry 121201

Vertical movements along the margins of the Atlantic Ocean ...... See Entry 121202

The Triassic rift system of the Western Siberian plate and its effect on the structure and the oil and gas potential of the Mesozoic-Cenozoic platform mantle ...... See Entry 121203

Tectonic thrust sheets in central Chukotka ...... See Entry 121204

A tectonophysical analysis of fracturing on the example of the Valkumei tin-ore field (Chukotka Peninsula) ...... See Entry 121205

Sedimentary environments and postglacial history of the Fraser Delta and lower Fraser Valley, British Columbia ...... See Entry 121207

On the opening of a crack in rocks ...... See Entry 121223

Geophysical approach to the structural interpretation of the Lake Becancour region, Thetford Mines, Quebec ...... See Entry 121233

Volatiles in basalts and andesites from the Galapagos Spreading Center, 85° to 86°W ...... See Entry 121234

Forced vibrations and integral equations of a fluid resonator. Applications to the study of fissures in the middle of rocks ...... See Entry 121235

The development of the Beret uplift and its conjugate depressions during the Late Precambrian in the northwestern part of the Eastern Sayan region ...... See Entry 121237

The morphology of the gabbroid plutons and scale of basic magmatism in the Ol'khon area ...... See Entry 121238

On the age of the basal strata of the Ordovician to Middle Devonian complex in the northwestern Altai region ...... See Entry 121239

Some distinctive features of the crustal structure and metallogeny of the southern frame of the Siberian platform ...... See Entry 121240

Haughton impact structure: structural and morphological aspects ...... See Entry 121247

^{10}Be and Be in the Maurice River-Union Lake system of southern New Jersey ...... See Entry 121296

Search for ^{36}Sl in Stripa site groundwaters ...... See Entry 121304

Terrestrial fission xenon: choice of primordial isotopic composition ...... See Entry 121375

γ-ray spectrometric determination of uranium-series nuclides in marine phosphorites ...... See Entry 121379

FANTASIA—a program for target transformation factor analysis to apportion sources in environmental samples ...... See Entry 121387

The correction for sediment loading on the seafloor ...... See Entry 121396

91.40 VOLCANOLOGY

121180 Geometry of magma bodies beneath Long Valley, California determined from anomalous earthquake signals. C.O.Sanders, F.Ryall (Seismological Lab., Univ. of Nevada, Reno, NV, USA).
Geophys. Res. Lett. (USA), vol.10, no.8, p.690-2 (1983).
One hundred and ninety-two small earthquakes which occurred recently near the southern edge of Long Valley caldera at depths from 1 to 13 km are used to map the subsurface geometry of magma bodies in the caldera. Seismograms of these events recorded northwest, north, northeast, and east of Long Valley with ray paths through the caldera are often anomalous in that S-wave arrivals are absent and high frequency P-wave energy is missing. These anomalous ray paths intersect in an area of the south-central caldera which are interpreted to be a region of molten or partially molten rock. This magma body lies between about $4^1/_2$ and at least 13 km depth and is 10 km long by 5 km wide beneath 7 km. (8 refs.)

121181 Determination of timing of volcanic events by secular variation and thermal modeling. K.P.Furlong, P.N.Shive (Dept. of Geology & Geophys., Univ. of Wyoming, Laramie, WY, USA).
Geophys. Res. Lett. (USA), vol.10, no.8, p.701-4 (1983).
The length of time between emplacement of successive lava flows is difficult to determine with high resolution except in regions of very recent or current activity. In paleomagnetic studied, a tacit assumption of the relative timing is made by considering the effects of secular variation to be averaged in samples from a series of flows, a condition which may not in fact be met. Through the combined use of numerical modeling of the cooling history of sequences of lava flows and detailed measurements of the magnetization directions from field samples, constraints can be replaced on the length of time between flows. As individual flow units in a sequence cool, the position within each flow of the last point to pass through the blocking temperature is a function of the relative timing of the flows in the sequence. Additionally, the depth into an underlying flow to which magnetic directions are reset is also a function of this relative timing. (23 refs.)

121182 Volcanic eruptions in the Mediterranean before AD 630 from written and archaeological sources. R.B.Stothers, M.R.Rampino (Goddard Inst. for Space Studies, NASA, New York, NY, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6357-71 (10 Aug. 1983).
Written and archaeological sources from the Mediterranean region have been exhaustively searched for evidence of historical volcanism before the year AD 630. Volcanic eruptions are identified by two methods: direct observations, which give information about Mediterranean volcanoes, and indirect, atmospheric observations, which give at least the dates of very explosive eruptions have occurred somewhere in the northern hemisphere. Seven or more very large explosive eruptions have been detected by these methods. Direct observations indicate great eruptions of Thera, Etna and Vesuvius. Indirect observations imply great eruptions of northern hemisphere volcanoes in the years 217 BC, 44 BC, AD 472, AD 536 and AD 626. Atmospheric veiling and cooling were quite marked for about a year after the eruptions of 44 BC, AD 472, AD 536, and AD 626. (90 refs.)

121183 Effects of melt density on magma mixing in calc-alkaline series lavas. T.L.Grove, M.B.Baker (Dept. of Earth & Planetary Sci., MIT, Cambridge, MA, USA).
Nature (GB), vol.305, no.5933, p.416-18 (29 Sept. 1983).
Discusses the melt density variations expected to occur during differentiation in calc-alkaline magma systems, and shows how these density changes can influence the generation and chemical composition of mixed magmas. It is assumed that fractional crystallization of basaltic melt is the dominant process in generating the association high alumina basalt, basaltic andesite, andesite, dacite and rhyolite. Liquid density variations may explain the origin of the mixed basaltic andesites and andesites at Medicine Lake. (21 refs.)

121184 Scanning electron microscopic examination of pyroclastic materials: basic considerations. M.F.Sheridan, J.R.Marshall (Dept. of Geology, Arizona State Univ., Tempe, AZ, USA).
Scanning Electron Microsc. (USA), pt.1, p.113-18 (1983). (Scanning Electron Microscopy 1983 Conference, Dearborn, MI, USA, 17-22 April 1983).
There is no generally accepted methodology for the examination of pyroclastic particles with the scanning electron microscope (SEM). The present work has revealed the urgent need for a careful and thorough approach to be established. An examination of more than 2000 grains from volcanic deposits led to the finding that an extremely large array of surface textures can be present in the deposits of one eruption. Each particle reveals a different aspect of the deposit's history depending on its size and type. The complexity of pyroclastic material demands consideration of field relationships, grain-size populations and grain types selected for study, sample preparation, the statistical validity of the sample size, and SEM techniques of examination and analysis. There is no short route to characterizing a pyroclastic deposit. (12 refs.)

121185 The dynamics of the melting of lithosphere rocks and the lateral inhomogeneities of the magmatism of island arcs. V.N.Sharapov, V.G.Melamed (Inst. of Geology & Geophys., Acad. of Sci., Novosibirsk, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.6, p.27-34 (1982). Translation of: *Geol. & Geofiz. (USSR)*, vol.23, no.6, p.33-40 (1982). [received: Oct. 1983]
Considers the dynamics of the melting of lithosphere rocks in the region of a seismic focal zone. The known data on the lateral variations of the magmatism of island arcs are discussed in this light. (68 refs.)

Rb-Sr and U-Pb dating of bentonites ....See Entry 121163

Volatiles in basalts and andesites from the Galapagos Spreading Center, 85° to 86°W ....See Entry 121234

The development of the Beret uplift and its conjugate depressions during the Late Precambrian in the northwestern part of the Eastern Sayan region ....See Entry 121237

The morphology of the gabbroid plutons and scale of basic magmatism in the Ol'khon area ....See Entry 121238

Mauna Loa sky conditions—bench mark and present ....See Entry 121371

91.45 PHYSICS OF PLATE TECTONICS

121186 Dynamic stress drops of moderate earthquakes of the Eastern Aleutians and their relation to a great earthquake. J.Mori (Lamont-Doherty Geological Obs., Columbia Univ., Palisades, NY, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1077-97 (Aug. 1983).
Short-period WWSSN records are used to calculate dynamic stress drops of moderate earthquakes (m_b=5.5 to 6.1) in the Eastern Aleutians, Alaska. For short-period pulses where scattering effects often distort the pulse shape, estimates of dynamic stress drop using the formula of Boatwright (1980) have fewer sources of uncertainty than does the formula for static stress drop given by Brune (1970, 1971). Earthquakes of several tectonic settings within the subduction zone are studied: shallow (5 to 8 km) normal faulting events near the trench; earthquakes in the main thrust zone (30- to 50-km depth), and intermediate-depth (100 to 200 km) earthquakes in the Benioff zone. (24 refs.)

121187 Geodetic measurements of postseismic crustal deformation following the 1979 Imperial Valley earthquake, California. J.Langbein, A.McGarr, M.J.S.Johnston, P.W.Harsh (US Geological Survey Office of Earthquakes, Menlo Park, CA, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1203-24 (Aug. 1983).
A geodetic trilateration network comprising 54 baselines was established around the northern part of the imperial fault beginning 12 days after the Imperial Valley earthquake of 15 October 1979, and the line lengths were repeatedly observed during the following 110 days. During the observational period, there was an average of about 10 cm of dextral postseismic fault slip. Geodetic data in conjunction with alignment-array measurements indicate that the postseismic slip U at time t following the main shock is well described by $U(t)=(10.96\pm0.12)$ cm $\log(t/1.75$ days$+1)$, a result that implies that it will be approximately 9 to 10 yr before the rate of postseismic displacement diminishes to the ambient rate of creep of 0.5 cm/a. (23 refs.)

121188 Kinematic history of the Narragansett Basin, Massachusetts, and Rhode Island: constraints on Late Paleozoic plate reconstructions. S.Mosher (Dept. of Geological Sci., Univ. of Texas, Austin, TX, USA).
Tectonics (USA), vol.2, no.4, p.327-44 (Aug. 1983).
The formation of the Narragansett Basin of Rhode Island and Massachusetts and the polyphase deformation geometry of the Pennsylvanian-age basin sediments can be explained by collision and strike slip interactions between an Avalonian microcontinent, the European-North American plate, and the African plate. During the late Paleozoic, sinistral movement between an Avalonian microcontinent and the European-North American plate resulted in formation of pull apart basins. Subsequently, Africa moved toward North America along an east-west trending, dextral megashear zone and collided with the eastern margin of southern North America. The Narragansett Basin is located on the Avalonian microcontinent near the suture with the North American continent and in the transition zone between the megashear and the collision tectonic regimes. The basin shape, stratigraphy, and sedimentary relationships can be explained by the coalescence of two composite grabens which formed at different times. (90 refs.)

121189 Normal faulting, block tilting, and decollement in a stretched crust. J.-P.Brun, P.Choukroune (Centre Armoricain d'Etude Structurale des Socles, Univ. de Rennes, Rennes, France).
Tectonics (USA), vol.2, no.4, p.345-56 (Aug. 1983).
Stretched portions of the crust exhibit complex faulting patterns at upper levels with high-angle and low-angle normal faults. It is difficult to extrapolate surface observations to the crustal scale. Five general models are proposed that combine continuous and discontinuous deformation and geometrical and geological tests are proposed. Two natural examples, the West Armorican Atlantic margin and Eldorado Mountains (Basin and Range Province), are presented. They are characterized by an association of high-angle normal faults, tilted blocks, and low-angle normal faults. Field and geometrical arguments are given to demonstrate that low-angle faults are controlled by decollement surfaces along preexisting interfaces. Geometrical implications of the tilted block pattern are presented and the gravity gliding hypothesis is proposed as a possible explanation of block tilting when associated with low angle normal faults. (47 refs.)

121190 Influence of plate subduction on isostatic compensation in northern California. M.K.McNutt (Dept. of Earth, Atmospheric, & Planetary Sci., MIT, Cambridge, MA, USA).
Tectonics (USA), vol.2, no.4, p.399-415 (Aug. 1983).
The isostatic gravity map for northern California calculated by the US Geological Survey on the assumption of Airy compensation reveals a residual correlation between gravity and topography. Peaks in the Klamath and Siskiyou Mountains west of 122.25°W and north of 40°N are associated with isostatic gravity highs in excess of 100 gu (gravity units), while to the east the Cascade volcanoes Lassen and Shasta display gravity lows less than −300 gu. Admittance calculations which determine the correlation between Bouguer gravity and topography demonstrate that some of the difference in isostatic gravity signature for the Klamaths and Cascades can be attributed to density variations in surficial rock types. Interpretations of response functions and direct modelling indicate that the Klamath Mountains are rootless structures supported by the rigidity of the underlying Gorda plate, while the Cascades are locally compensated by shallower, low-density material within the North American plate. (37 refs.)

121191 The mean life of continents: estimates of continent recycling rates from Nd and Hf isotopic data and implications for mantle structure. D.J.DePaolo (Dept. of Earth & Space Sci., Univ. of California, Los Angeles, CA, USA).
Geophys. Res. Lett. (USA), vol.10, no.8, p.705-8 (1983).
An analysis of the initial neodymium and hafnium isotopic compositions of modern and ancient mantle-derived rocks shows that the divergence of the mantle ^{143}Nd/^{144}Nd and ^{176}Hf/^{177}Hf ratios from the chondritic ratios over the past 2 billion years has been much less than would be expected based on the Sm/Nd and Lu/Hf ratios of the mantle source of mid-ocean ridge basalt. The most likely explanation is that rock material from the continents has been recycled semi-continuously back into the mantle over this time period. The required rate of return of continents to the mantle, calculated from a simple transport model, is about 0.35 ± 0.15 of the continental mass per billion years ($\sim$2.5 km^3/year). This result is consistent with the hypothesis that the mass of the continents has been approximately constant since the late Archean, and implies that recycled continental material must be an important component of the upper mantle. (36 refs.)

121192 Mechanism of earthquake foci and stressed state of Iranian plate. T.A.Annaorazova (O.Yu. Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.8 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.8, p.567-71 (1982). [received: Sept. 1983]
The state of stress of the Iranian Plate is investigated on the basis of results of determination of earthquake focal mechanisms. The relative movement of the plate is shown to cause a state of stable uniaxial horizontal compression. The direction of the movement of the Iranian Plate is determined. (8 refs.)

121193 The spatial patterns of the aftershock strain of the focal region of a strong earthquake. O.A.Kuchai (Tashkent Div., Inst. of Earthquake Resistant Construction & Seismology, Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.785-9 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
Following the data of the focal mechanisms of 95 aftershocks (K=12-15) of the Markansu earthquake of Aug. 11, 1974, in the northern Pamirs, the author calculates the values of six components of the strain tensor in the geographic coordinate system. A comparison is made of the components of the strain tensor of the aftershock process and of the components of the strain tensor of the main shock. The focal region of the main event is marked out by the distribution of the values of the components of the strain tensor of the aftershock process, and the dimensions of the rupture of the Markansu earthquake are determined. (13 refs.)

121194 Seismotectonic strain of the crust of the southern part of central Asia. Yu.V.Riznichenko, O.V.Soboleva, O.A.Kuchai, R.S.Mikhailova, O.N.Vasil'yeva (O.Yu. Schmidt Earth Phys. Inst., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.809-20 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
The results of a calculation and analysis of the components of the strain rate tensor during seismic flow of rock masses of the crust of the Tadzhik depression and orogens of the Pamir and Northern Hindu Kush are presented. The nature of the seismotectonic deformation of the crust is described by the Lode-Nadai coefficient and by the orientation of the lines of maximum shortening and maximum elongation. (38 refs.)

121195 Problems in study of seismotectonic deformation of rock masses. I.L.Nersesov, S.Kh.Negmatullaev, A.A.Lukk, S.L.Yunga (O.Yu. Schmidt Inst. of Phys. of Earth, Acad. of Sci., Tadzhik SSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.821-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
The possibility of studying the seismotectonic deformation in an area of central Asia and Kazakhstan on the basis of determinations of earthquake focal mechanisms is shown. A diagram of the geological-tectonic division of the region is presented and calculation of the parameters of the average mechanisms from published data is given for a number of regions. (33 refs.)

121196 Seismic flow of rock masses in the Caucasus. E.A.Dzhibladze (Inst. of Geophys., Acad. of Sci., Georgian SSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.826-31 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
Maps are constructed of the distribution of the components of the rate-of-strain tensor in the seismic flow of rock masses. The parameters of the long-term average seismicity, γ, A, and K_{max}, as well as data on the focal mechanisms of Caucasian earthquakes, served as the initial data. (10 refs.)

121197 Some basic regularities in the seismotectonic deformation of the Kuril-Kamchatka region over 1929-1973. M.A.Danilova, S.L.Yunga (O.Yu. Schmidt Inst. of Phys. of Earth, Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10, p.832-40 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10 (1982). [received: Sept. 1983]
A study is made of the seismotectonic deformation in the Kuril-Kamchatka seismic zone on the basis of the catalog of the focal mechanisms of strong earthquakes ($M\geq4.5$) over the period from 1929-73, published by World Data Center 'A'. A picture of the spatial distribution of the average mechanisms in the Kuril-Kamchatka region was obtained. (29 refs.)

121198 Early Tertiary subduction zones and hot spots. D.M.Jurdy (Dept. of Geological Sciences, Northwestern Univ., Evanston, IL, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6395-402 (10 Aug. 1983).
The purpose of this paper is to argue that a changing configuration of subduction zones between the early Tertiary and the present has caused the 10° of true polar wander observed in the hot spot framework. First, the evidence that true polar wander has occurred is reviewed. Second, it is argued that the distribution of subduction zones and hot spots control the present maximum axis of inertia. Third, from early Tertiary reconstructions, the position of the maximum axis of inertia will be estimated from surface arrangements for that

time and shown to be in good agreement with the position of the spin axis, as determined from comparison of the paleomagnetic and the hot spot reference frames. Finally, the implications for plate motions are considered for the premise that the inertia tensor of the subducting slabs and hot spots control the location of the spin axis. (38 refs.)

121199 Convection in a two-layer mantle with a strongly temperature-dependent viscosity. P.M.Kenyon, D.L.Turcotte (Dept. of Geological Sci., Cornell Univ., Ithaca, NY, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6403-14 (10 Aug. 1983).
Recent geochemical and isotopic data support the hypothesis that the Earth's mantle convects in two separate layers with an interface at the 650-km seismic discontinuity. this paper studies the implications of this hypothesis with regard to the thermal boundary layers that are expected to develop adjacent to the interface between the convecting layers. The authors are particularly concerned with a possible decrease in the mantle viscosity across this interface. In order to study the structure of the thermal boundary layers in a fluid with a strongly temperature-dependent viscosity an approximate method developed by Howard (1966) is utilised. If the upper and lower mantle have the same viscosity law, then the stratified convection requires a lower mantle viscosity which is several orders of magnitude lower than the upper mantle viscosity. (68 refs.)

121200 Gloria observations of the propagating rift at 95.5°W on the Cocos-Nazca spreading center. R.C.Searle, R.N.Hey (Scripps Instn. of Oceanography, La Jolla, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6433-47 (10 Aug. 1983).
Presents Gloria long-range sidescan sonar survey of the area around 95.5°W on the Cocos-Nazca Rise, where a propagating rift has been predicted to occur. The sonar images clearly show a wedge of new crust that has been emplaced by propagation into 1-Ma-old crust. The new crust is up to 800 m deeper than the surrounding seafloor, although the elevation difference appears to decay with time. The 'pseudofaults' which bound this new crust have been observed from the rift tip back to crustal isochron 0.65 Ma. Near the rift tip they consist of scarps several hundred metres high with narrow, shallow valleys at their feet. The authors describe the detailed crust structure and tectonics of this area. (23 refs.)

121201 Rotation of the Peruvian Block from palaeomagnetic studies of the Central Andes. K.Heki, Y.Hamano (Geophysical Inst., Univ. of Tokyo, Tokyo, Japan), M.Kono.
Nature (GB), vol.305, no.5934, p.514-16 (6 Oct. 1983).
Palaeomagnetic studies were performed on the rocks of the Central Andes to test the hypothesis of oroclinal bending of the Andes around the Peru-Chile border. Natural remanent magnetization of Mesozoic volcanic and sedimentary rocks of Peru shows a counterclockwise shift of declination by several tens of degrees relative to the field directions of the same ages in the stable south American craton. Two Mesozoic dyke swarms from Arica region (northernmost Chile) also indicate about 20° of declination shift in a counterclockwise sense. These results suggest a considerable amount of counterclockwise rotation of large area north of Arica, that is, oroclinal bending of the Andes around some hinge near the Peru-Chile border. If this declination shift is a result of the wide-area tectonic rotation as suggested by the Mesozoic rocks, oroclinal bending appears to have continued until relatively recent times. (14 refs.)

121202 Vertical movements along the margins of the Atlantic Ocean. I.S.Gramberg, E.M.Litvinov.
Sov. Geol. & Geophys. (USA), vol.23, no.6, p.9-12 (1982). Translation of: *Geol. & Geofiz. (USSR)*, vol.23, no.6, p.12-17 (1982). [received: Oct. 1983]
The geophysical fields on the periphery of the Atlantic Ocean testify to the occurrence of considerable downward vertical movements along the continental margins; these movements have resulted in the formation of separate microcontinents in the abyssal regions of the ocean. (8 refs.)

121203 The Triassic rift system of the Western Siberian plate and its effect on the structure and the oil and gas potential of the Mesozoic-Cenozoic platform mantle. V.S.Surkov, A.A.Trofimuk, O.G.Zhero, A.E.Kontorovich, L.V.Smirnov (Inst. of Geology & Geophys., Acad. of Sci., USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.8, p.1-12 (1982). Translation of: *Geol. & Geofiz. (USSR)*, vol.23, no.8, p.3-15 (1982). [received: Oct. 1983]
Considers the structure and specific features of development of the Triassic rift system of the Western Siberian plate, and describes the morphological, geologic, and geophysical characteristics of the rift zones. It is shown that the rift system determined the formation of the Mesozoic-Cenozoic sedimentation basin of Western Siberia and the speical type of structures in its sedimentary mantle. This system predetermined the distribution of facies and thicknesses of the sedimentary mantle, and the intensified tectonic activity and thermal regime above the rift zones promoted the formation of oil and gas bodies. (19 refs.)

121204 Tectonic thrust sheets in central Chukotka. I.V.Tibilov (Chaun Geologic Exploration Expedition, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.8, p.64-9 (1982). Translation of: *Geol. & Geofiz. (USSR)*, vol.23, no.8, p.70-5 (1982). [received: Oct. 1983]
Describes the large thrust sheets and nappes on the eastern coast of Chaun Bay. It is chiefly the sandstone bodies of Triassic age, as well as the Aptian coal measures, that have undergone mass lubricate thrust here. The autochthone is represented by silty-pelitic deposits, and more rarely Triassic flyschoid deposits. The Early Cretaceous (pre-granite) age of the tectonic thrust sheets and nappes is established. The depression of Chaun Bay and the Chaun lowland is evidently confined to the zone of a very large displacement in the Late Mesozoic, to the development of which the formation of the large tectonic nappes and thrust sheets was directly related. (3 refs.)

121205 A tectonophysical analysis of fracturing on the example of the Valkumei tin-ore field (Chukotka Peninsula). I.S.Boikov (Central Res. Inst. of Tin, Novosibirsk, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.8, p.70-5 (1982). Translation of: *Geol. & Geofiz. (USSR)*, vol.23, no.8, p.75-80 (1982). [received: Oct. 1983]
The specific features of the development of fracturing in the ore-forming stage are considered in detail; this stage is divided into a series of phases of rupturing, each preceding a corresponding phase of hydrothermal mineralization. It is shown that the rupture systems of each phase are complex formations, and that the fractures of which they are composed belong to different morphological types: strike-slips, combined strike-slip and reverse or normal faults, and reverse faults. The tectonic stress fields under the conditions of which the fracturing took place are reconstructured for each of these phases. (7 refs.)

Modelling of vertical crustal movements by means of collocation .... See Entry 121090

New paleomagnetic data for the Triassic Guichon batholith of south-central British Columbia and their bearing on Terrane I tectonics .... See Entry 121094

Late Cretaceous apparent polar wander of the Pacific plate: evidence for a rapid shift of the Pacific hotspots with respect to the spin axis .... See Entry 121095

Palaeomagnetism of Lower Cretaceous tuffs from Yukon-Kuskokwim delta region, western Alaska .... See Entry 121104

A specific barrier model for the quantitative description of inhomogeneous faulting and the prediction of strong ground motion. II. Applications of the model .... See Entry 121108

Seismicity in the St. Elias region of northwestern Canada and southeastern Alaska .... See Entry 121115

Outer-rise earthquakes and seismic coupling .... See Entry 121123

The physical model of the sources of deep-focus earthquakes .... See Entry 121125

Strong earthquakes in the Eastern Caucasus: interpretation of historical data and analysis of geological situation .... See Entry 121140

Possible seismic reflections from the downgoing Pacific plate, 275 kilometers arcward from the Eastern Aleutian Trench .... See Entry 121141

Nonlinear strain buildup and the earthquake cycle on the San Andreas fault .... See Entry 121145

Age dependence of oceanic intraplate seismicity and implications for lithospheric evolution .... See Entry 121146

The dendrochronological dating of seismogenic ruptures in the Stanovoi highland .... See Entry 121156

The carbonate-silicate geochemical cycle and its effect on atmospheric carbon dioxide over the past 100 million years .... See Entry 121159

The geology and structural history of the Cape Ray Fault Zone in southwestern Newfoundland .... See Entry 121161

Continental hypsography .... See Entry 121164

On a model of the upper layers of the Earth's crust .... See Entry 121166

Generation of arc basalt magmas and thermal structure of the mantle wedge in subduction zones .... See Entry 121167

Surface deformation associated with a dipping hydrofracture .... See Entry 121168

Average regional strain due to slip on numerous faults of different orientations .... See Entry 121170

Metamorphic and tectonic evolution of granulites, Arunta Block, central Australia .... See Entry 121172

The Mesozoic marginal basin of central Peru .... See Entry 121173

Lithospheric stretching and North Sea Jurassic clastic sourcelands .... See Entry 121176

Confirmation of the Carolina slate belt as an exotic terrane .... See Entry 121177

The dynamics of the melting of lithosphere rocks and the lateral inhomogeneities of the magmatism of island arcs .... See Entry 121185

Geophysical approach to the structural interpretation of the Lake Becancour region, Thetford Mines, Quebec .... See Entry 121233

The development of the Beret uplift and its conjugate depressions during the Late Precambrian in the northwestern part of the Eastern Sayan region .... See Entry 121237

On the age of the basal strata of the Ordovician to Middle Devonian complex in the northwestern Altai region .... See Entry 121239

The correction for sediment loading on the seafloor .... See Entry 121396

91.50 MARINE GEOLOGY AND GEOPHYSICS

121206 A statistical study of the cliff top slumps in part of the Christchurch Bay coastal cliffs. M.E.Barton, B.J.Coles, G.R.Tiller (Dept. of Civil Engng., Univ. of Southampton, Southampton, England).
Earth Surf. Processes & Landforms (GB), vol.8, no.5, p.409-22 (Sept.-Oct. 1983).
A distinction is made between slumping and spalling. Slumping involves a compound slide with rotation and translation: the latter along one of the bedding plane sheat surfaces in the Barton beds. Spalling is an isolated failure of the exposed cliff face due to weathering. Where slumping is the dominant mode of cliff top recession, the latter is an incremental process with the increments being equal to the breadth of the slumps. A statistical study is made of the breadth, length and plan area of 42 slumps observed over a 2 km stretch of the Christchurch Bay coastal cliffs and significant trends deduced. (9 refs.)

121207 Sedimentary environments and postglacial history of the Fraser Delta and lower Fraser Valley, British Columbia. J.J.Clague (Terrain Sci. Div., Geological Survey of Canada, Vancouver, BC, Canada), J.L.Luternauer, R.J.Hebda.
Can. J. Earth Sci. (Canada), vol.20, no.8, p.1314-26 (Aug. 1983).
The Fraser River delta has been built into the Strait of Georgia in southwestern British Columbia during the Holocene. Present-day sedimentary environments, including foreslope, tidal flat, river channel, floodplain, and bog, also existed earlier during the delta's development. Initial growth of the Fraser Delta was preceded both by deglaciation of the region and by the rapid westward extension of the Fraser River floodplain down a partially submerged, glacially scoured trough east of New Westminster. About 10000 years ago, the Fraser River began to empty directly into the Strait of Georgia through a gap in the Pleistocene uplands at New Westminster. (43 refs.)

121208 Temporal variations of beam attenuation coefficient on the continental rise off Nova Scotia. Hasong Pak, J.R.V.Zaneveld (School of Oceanography, Oregon State Univ., Corvallis, OR, USA).
J. Geophys. Res. (USA), vol.88, no.C7, p.4427-32 (20 May 1983). [received: Oct. 1983]
Two separate time series observations of light transmission in the bottom water on the Continental Rise off Nova Scotia show fluctuations of light transmission in a wide range, 0.50% transmission at $\lambda=660$ nm. The range corresponds approximately to SPM concentrations of 12 mg/l to 150 μg/l. Nepheloid layers of significant turbidity, called benthic storms, were observed in 30 and 10% of the time, respectively, for the two observations, and each storm lasted 2-5 days. High frequency fluctuations represented by pulse lengths less than 10 min were observed superimposed on the low frequency fluctuations during 16 and 4% of the time. Both the major storms and the high frequency pulses are interpreted to be a result of resuspension of bottom sediments at varying distances from the instrument. (10 refs.)

121209 A model for shoreline evolution around a river mouth. Ming-Chung Lin (Graduate School of Harbor & Ocean Engng., Nat. Taiwan Coll. of Marine Sci. & Technol., Keelung, Taiwan), Jyh-Cherng Wang.

J. Chin. Inst. Eng. (Taiwan), vol.6, no.3, p.141-51 (July 1983). In Chinese.

Proposes a model for predicting long-term shoreline evolution by incorporating certain river parameters into the Willis beach evolution model. The proposed model is at first applied to four ideal cases to investigate its general characteristics and adaptability, and good results are found. Finally, as an application of the model, a numerical simulation of shoreline changes around the Cho-shui River mouth is performed and compared with field data. Rasonable agreement is found. (18 refs.)

121210 Geochemical evidence of a massive slide in the southern Norwegian Sea. G.J.de Lange (Dept. of Geochem., State Univ. of Utrecht, Utrecht, Netherlands).

Nature (GB), vol.305, no.5933, p.420-2 (29 Sept. 1983).

During the 1981 cruise of the MS Tyro to the southern Norwegian Basin several piston-cores were collected for sedimentological research. Some of these were available for geochemical study. In laboratory analyses the pore water composition of one of these cores showed evidence of input of non-saline water, whereas pore water in other cores from the same basin did not give any indication of dilution with fresh water. Careful examination of the chemical constituents of the pore water and some parameters of the sediment gives convincing evidence for the origin of the fresh water. The presence of non-saline water can be attributed to a massive slide of a coastal fresh-to-brackish sediment 'slab', with preservation of structural and pore water composition. This sliding is thought to have taken place about 12000 to 15000 years BP. (52 refs.)

Gloria observations of the propagating rift at 95.5°W on the Cocos-Nazca spreading center .... See Entry 121200

Volatiles in basalts and andesites from the Galapagos Spreading Center, 85° to 86°W .... See Entry 121234

Flandrian relative sea level changes in the Ythan valley, northeast Scotland .... See Entry 121251

γ-ray spectrometric determination of uranium-series nuclides in marine phosphorites .... See Entry 121379

Remote acoustic classification of marine sediments with application to offshore Newfoundland .... See Entry 121385

91.60 PHYSICAL PROPERTIES OF ROCKS AND MINERALS

121211 The solubility of calcite and aragonite in sweater at various salinities, temperatures, and one atmosphere total pressure. A.Mucci (Dept. of Oceanography, Texas A&M Univ., College Station, TX, USA).

Am. J. Sci. (USA), vol.283, no.7, p.780-99 (Sept. 1983).

The stoichiometric solubility constants of calcite and aragonite in seawater were determined over a wide range of salinity (5-44 per mil) and temperature (5°-40°) at 1 atm. total pressure. The measurements were carried out from both supersaturated and undersaturated solutions using a closed system technique. The solutions were equilibrated with carbonate solids for periods ranging from 5 days to almost 2 yrs. This study represents the only long term equilibration investigation of the stoichiometric solubility of aragonite in seawater. (55 refs.)

121212 The α-β transition of quartz; a view of some current problems: order-disorder or displacive transition, thermodynamic behaviour. G.Dolino, J.-P.Bachheimer (Lab. de Spectrometrie Phys., Saint-Martin-d'Heres, France), F.Gervais, F.Wright.

Bull. Mineral. (France), vol.106, no.3, p.267-85 (1983). In French.

This paper presents a review of some recent results. The possibility that the high temperature β phase is disordered has recently been supported by a neutron diffraction structure determination. The Landau theory of first order phase transitions gives a good description of the behaviour of the α phase right up to the α-β transition. However the β phase presents anomalous features which cannot be explained within the framework of this simple theory. The interface between α and β phase is inhomogeneous and gives rise to important light scattering. A soft mode corresponding to rotations of SiO_4 tetrahedra has been observed. The dynamic behaviour of the other vibration modes is also perturbed by the transition. In the β phase, an overdamped soft mode has been measured by neutron scattering, which indicates anharmonic motion in a potential well which may have several minima. A description in terms of dynamic correlated disorder may well be the best model to take account of apparently divergent experimental observations. (103 refs.)

121213 Dissociation of *c* dislocations in sillimanite Al_2SiO_5. A.Lefebvre, J.Paquet (Univ. des Sci et Tech. de Lille, Villeneuve D'Ascq, France).

Bull. Mineral. (France), vol.106, no.3, p.287-92 (1983).

c dissociated dislocations with variable dissociation widths (from 300 Å to a few microns) are systematically found in sillimanite studied by transmission electron microscopy. The corresponding stacking faults (with displacement vector 1/2 [001]) only slightly alter the anionic sublattice of the structure but they modify the order of Al and Si cations among the tetrahedral interstices; the resulting degree of disorder depends on the orientation and the location of the faults in the structure. The observed (*hk* 0) preferred orientations of the faults tend to minimize the disorder, but this disorder should not be ignored as it may have significant effects on phase relations of of the Al_2SiO_5 polymorphs. (17 refs.)

121214 Photoacoustic spectra of natural apatites in the near ultraviolet and visible regions. P.Sladky (Dept. of Chem. Phys., Charles Univ., Prague, Czechoslovakia), Z.Pacl, P.Hegner, R.Rericha.

J. Photoacoust. (USA), vol.1, no.3, p.387-93 (1982-1983). [received: Oct. 1983]

Ten natural apatites from Tunisia, Senegal, USA, Jordon, Morocco, USSR, Spanish Sahara, Egypt, and Algeria were studied by photoacoustic spectroscopy in the 260-760 nm region. The PA spectra obtained from powders (below 0.1 mm, above 150 mesh) are characteristic for the apatites and can be used for their identification. Although no district bands were observed under a relatively low resolution, the integrated intensity or the maximum PA signal can be used as a measure of the 'colouredness' of the sample. The absorption increasing from 760 to 260 nm is due to organic impurities (of the order of 1 wt.%) and minority transition elements, especially Fe (below 1 wt.%). (12 refs.)

121215 Thermal expansion and cracking of three confined, water-saturated igneous rocks to 800°C. S.J.Bauer, J.Handin (Center for Tectonophys., Texas A&M Univ., College Station, TX, USA).

Rock Mech. & Rock Eng. (Austria), vol.16, no.3, p.181-98 (Aug. 1983).

The thermal expansions of water-saturated Charcoal Granite, Mt. Hood Andesite, and Cuerbio Basalt have been measured at effective confining pressures (P_e) of 5, 50, and 100 MPa to 800°C. The mean coefficient of linear thermal expansion is a function of lithology, P_e, temperature and initial porosity (ϕ). The difference between measured values of thermal expansion and those calculated from simple mixture-theory relates to new crack porosity generated as a result of differential thermal expansion at the anisotropic grain scale. For the granite, a two to three order of magnitude increase in permeability (k) is predicted from the relation, $k \propto \phi^3$. (44 refs.)

121216 Solubility of corundum in supercritical water. K.H.Becker, L.Cemic, K.E.O.E.Langer (Inst. fur Mineralogie und Kristallographie, Tech. Univ., Berlin, Germany).

Geochim. & Cosmochim. Acta (GB), vol.47, no.9, p.1573-8 (Sept. 1983).

The isothermal (670-700°C) solubility of corundum in supercritical water, within the stability range of corundum as a phase of the system Al_2O_3-H_2O, has been determined by the weight loss method. Experiments were performed in the pressure range 2.5 to 6 kbar and in the pressure range 10 to 20 kbar. All data could be fitted by the linear equation $S[\text{ppm } Al_2O_3] = -12.37 + 7.24.p[\text{kbar}]$ with correlation coefficient $r=0.9963$. (27 refs.)

121217 Precursors of the destruction of a large rock sample. G.A.Sobolev, A.A.Semerchan, B.G.Salov, H.A.Spetzler, C.H.Sondergeld, V.N.Badanov, A.V.Kol'tsov, V.F.Los', R.M.Nasimov, A.V.Ponomarev, I.R.Stakhovskii, V.A.Terent'ev, I.M.Turetskii (O.Yu. Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).

Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.8, p.572-80 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.8 (1982). [received: Sept. 1983]

The process and precursors of the destruction of a granite sample with a 50000-ton press is investigated. This involved the measurement of strains, acoustic and electromagnetic emissions, propagation velocity and amplitude of elastic waves, electric resistance, and intrinsic electrization. It is established that, before the local internal destruction of sample areas, substantial changes in the spatial distribution of the above quantities are observed which can be classified as destruction precursors. The effects of nonuniformity of the rock on the preparation and development of the destructive process and the magnitude and spatial distribution of the precursors investigated. (8 refs.)

121218 Shock polymorphism of manganese fluoride. V.N.German, A.M.Podurets.

Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.8, p.587-90 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.8 (1982). [received: Sept. 1983]

A study is presented on the shock compressibility of manganese fluoride, as well as an X-ray study of samples shock-compressed at pressures up to 80-350 kbar in containers made of steel and aluminum at initial temperatures of 10°C and −150°C. A break is found on the shock adiabatic curve which corresponds to a phase transition at a pressure of about 100 kbar. In compressed samples, phases are found with a rhombohedral structure of the α-PbO_2 and $PbCl_2$ type. Quantitative estimates of the phase composition are presented for the compressed samples. The polymorphism of manganese fluoride under dynamic and static squeezing is compared. (8 refs.)

121219 Evaluation of the magnetic structure of heterophase-altered titanomagnetites (based on oceanic basalts). D.M.Pecherskiy, V.A.Ivanov, L.Ye.Sholpo (Phys. Dept., Vladivostok State Univ., Vladivostok, USSR).

Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.8 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.8, p.607-11 (1982). [received: Sept. 1983]

On the basis of a study of the distribution of magnetic density on a preisach diagram for a series of oceanic basalt samples, it is established that the original homogeneous, multidomain titanomagnetites and products of their decomposition have practically the same magnetic structure. Heterophase-altered titanomagnetites also retain close to the original magnetic structure in a number of cases. The preservation of the magnetic structure during heterophase alteration of titanomagnetites has a great practical significance for paleomagnetic research, since the direction and apparently other properties of the original natural remanent magnetization of the rock must be preserved here. (15 refs.)

121220 Quantitative criteria for single- and multidomain states in ferromagnetic minerals in rocks. V.A.Ivanov, L.Ye.Sholpo (Inst. of Terrestrial Magnetism, Ionosphere, & Radio Wave Propagation, Acad. of Sci., USSR).

Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.8, p.612-16 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.8 (1982). [received: Sept. 1983]

On the basis of a comparison of a thermomagnetic criterion for the domain structure with magnetic-density distributions on a Preisach diagram, the characteristic features of these distributions are confirmed for rock samples containing single- or multidomain grains of ferromagnetic minerals. Simple numerical criteria for domain structure are established, calculated on the basis of ideal magnetization, remanent saturation magnetization, and the field disrupting it. (4 refs.)

121221 Magnetism of an ensemble of fine magnetite particles. K.A.Valeyev (Bashkir State Univ., Bashkir, USSR).

Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.8, p.617-22 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.8 (1982). [received: Sept. 1983]

Results are presented for a study of the magnetic properties of an ensemble of fine magnetite particles of various sizes. It is established that the magnetic parameters of the magnetite particles less than 35 μm in size depend to a substantial degree upon the methods of obtaining them. As the size of the particles decreases, the oxide surface layer affects the magnetic properties more and more. (22 refs.)

121222 Theory of thermoremanent magnetization in a multidomain grain of inhomogeneous magnetic hardness. V.P.Shcherbakov, G.P.Markov (O.Yu. Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).

Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.9, p.681-9 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.9 (1982). [received: Sept. 1983]

A theory of the formation of *TRM* in a multidomain grain containing both magnetically hard and magnetically soft sections is developed. Only hysteretic processes were examined, no allowance being made for the influence of thermoactivation effects. The phenomenon of the formation of negative *TRM* in the soft phase providing its blocking temperature $T(B_2)$ is below some critical value, was discovered. The *TRM* value with allowance for the effect of screening by the soft phase of the magnetic moment of the hard sections decreases with increase in the size L of the grain as L^{-1}, where $\gamma=(0.45$-$0.7)$, which is in good agreement with experimental data. The dependence $I_{ri}(H)$ is non-linear; in small fields $i_{rt} \sim H^{\alpha}$, $\alpha<1$, and with increase in the field the nature of the dependence changes and $I_{rt} \sim C_1 + C_2H^{\alpha}$. The problem of the effective demagnetization factor N for multidomain grains is examined in detail. (11 refs.)

121223 On the opening of a crack in rocks. M.Maiti, R.Paramguru (Dept. of Math., Indian Inst. of Technol., Kharagpur, India).
Indian J. Pure & Appl. Math., vol.14, no.9, p.1131-6 (Sept. 1983).
In connection with hydraulic fracture of an oil-bearing stratum, the problem of opening a crack in an infinite space has been discussed in the paper. The equilibrium boundary of the crack surface has been determined basing the analysis on dislocation layers. (5 refs.)

121224 The effects of aqueous chemical environments on crack and hydraulic fracture propagation and morphologies. J.D.Dunning (Dept. of Geology, Indiana Univ., Bloomington, IN, USA), W.L.Huf.
J. Geophys. Res. (USA), vol.88, no.B8, p.6491-9 (10 Aug. 1983).
The role of surface active aqueous environments in chemomechanical weakening of geologic materials is examined in light of the results of hydraulic fracture tests in sandstone, calorimetric studies, and crack propagation tests in synthetic quartz. In hydraulic fracture tests employing Crab Orchard Sandstone it was found that the effective hydraulic fracture pressure was reduced, over that attained with distilled water, when 5×10^{-4} M aqueous solutions of dodecyl trimethyl ammonium bromide (DTAB) were used as the hydraulic fracture medium. The degree of branching of the fractures was also increased in the presence of the DTAB solution. Previously reported crack propagation stress values in quartz exposed to distilled water and various DTAB solutions displayed the same trend. (24 refs.)

121225 Hysteresis in the closure of a nominally flat crack. C.H.Scholz, S.H.Hickman (Dept. of Geological Sci., Columbia Univ., Palisades, NY, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6501-4 (10 Aug. 1983).
It is shown that when two nominally flat rock surfaces are placed together and subjected to a normal load, the resulting closure closely follows a constitutive law predicted by theory. However, the constitutive law exhibits hysteresis. The hysteresis is evidently produced by friction on parts of the surface where the contact is oblique to the load. This behavior, which should be shared by joints and other fractures in the upper part of the crust, suggests that the elastic properties of the near-surface parts of the Earth may be far more complex than previously thought. (11 refs.)

121226 The dependence of magnetic domain structure upon magnetization state with emphasis upon nucleation as a mechanism for pseudo-single-domain behavior. S.Halgedahl, M.Fuller (Dept. of Geological Sci., Univ. of California, Santa Barbara, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6505-22 (10 Aug. 1983).
The stable carriers of the paleomagnetic record in rocks are commonly fine pseudo-single-domain (PSD) particles between about 1 and 20 μm in diameter. However, the underlying mechanism which determines PSD behavior has previously remained in debate. To study this problem, magnetic domain patterns have been observed with the Bitter method on particles of natural pyrrhotite and intermediate titanomagnetite in various magnetization states, including natural remanent magnetization (NRM), after alternating field demagnetization of the NRM and during high-field hysteresis. From these observations it is evident that two primary mechanisms govern high-field hysteresis behavior: (1) 'bulk' pinning of fully developed domain walls by intervening energy barriers, and (2) nucleation, the creation and expansion of walls into the particle volume to produce a fully developed domain structure. These observations demonstrate that nucleation can explain several important aspects of PSD behavior. (53 refs.)

121227 Detrital remanent magnetization in hematite. M.B.Steiner (Dept. of Geology/Geophys., Univ. of Wyoming, Laramie, WY, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6523-39 (10 Aug. 1983).
Heavy mineral placer layers within channel sandstones of the Morrison Formation (western United States) have been shown to contain a very stable, accurate record of the Jurassic geomagnetic field. These laminae are composed almost entirely of hematite grains; in particular, they are largely the hematite pseudomorph of magnetite, martite. The laminae record the correct geomagnetic field direction during a period of rapid apparent polar wander, which suggests an early acquisition of the remanence. Several other remanence characteristics imply that the remanence is probably a detrital remanent magnetization (DRM). (26 refs.)

121228 Progress of thermoluminescence research on geological materials. A.V.Sankaran, K.S.V.Nambi (Bhabha Atomic Res. Centre, Bombay, India).
Proc. Indian Natl. Sci. Acad. Part A, vol.49, no.1, p.18-112 (1983).
When the potential applications of thermoluminescence in the field of geochronology were recognized, detailed basic studies regarding the build up, stability and several other facets of thermoluminescence were taken up. Over the past few decades, many applications of this phenomenon to probe geological problems and processes were attempted. Among these can be mentioned the studies on sediments, stratigraphy, ore-prospecting, palaeoclimates and meteorites. The authors review the observations made regarding thermoluminescence in a number of minerals and also its application in some of the important branches in geology. Pertinent areas in the context of Indian geology are also furnished at the end, along with the methodology in field collection and laboratory practice. (310 refs.)

121229 Rocks behaviour under periodic load. C.Radu (Center of Earth Phys. & Seismology, Bucharest-Magurele, Rumania), I.Rugina, G.Winter, V.Winter.
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.2, p.201-9 (March-April 1983). [received: Sept. 1983]
The paper is devoted to the study of rock behaviour during compressive uniaxial periodic load under variable stresses. Three periodic loading modes were considered: I. $\sigma_{\min}$ and $\sigma_{\max}$ constant, with a uniform rate of load; II. $\sigma_{\min}$ constant and $\sigma_{\max}$ variable, with an increasing rate of load; III. $\sigma_{\min}$ and $\sigma_{\max}$ variable, with a uniform rate of load. Experimental results showed that the rock microfracturing process is statistically similar to an earthquake generating process. (13 refs.)

121230 Theoretical models of thermo-mechanical ductile shear zone deformation in rocks. J.M.Lockett.
Univ. Keele, England thesis, Sept. 1982
Thermo-mechanical models of ductile shear zones have been constructed for both viscous and viscoelastic materials. The viscous model has been applied to both shear zones and ductile thrusts for constant velocity and constant shear stress boundary conditions. For the constant velocity boundary condition the viscous shear zone model provides an explanation for a number of geological structures.

International Workshop on Strain Patterns in Rocks ....See Entry 116911

Effective conductivity of anisotropic medium with large number of cracks ....See Entry 121138

Dilatancy in brittle rocks ....See Entry 121152

Characteristics of the relation between density and longitudinal and transverse wave velocities in rocks .... See Entry 121179

The dynamics of the melting of lithosphere rocks and the lateral inhomogeneities of the magmatism of island arcs ....See Entry 121185

Geometry and kinematics of fault-bend folding ....See Entry 121231

Kink folds at Upper Manitou Lake, northwestern Ontario .....See Entry 121232

A new rock-magnetic approach to selecting sediments for geomagnetic paleointensity studies: application to paleointensity for the last 400 years ....See Entry 121395

Wireline logging and coal measures rock strength ....See Entry 121407

91.65 GEOPHYSICAL ASPECTS OF GEOLOGY, MINERALOGY AND PETROLOGY

121231 Geometry and kinematics of fault-bend folding. J.Suppe (Dept. of Geolog. & Geophysical Sci., Princeton Univ., Princeton, NJ, USA).
Am. J. Sci. (USA), vol.283, no.7, p.684-721 (Sept. 1983).
It is shown that many map-scale folds in sedimentary sequences are formed by the bending of fault blocks as they ride over non-planar fault surfaces; these structures are designated fault-bend folds. A number of geometric and kinematic properties of parallel fault-bend folds are described, and most important of which is a relationship between fault shape and fold shape for shape bends in faults. These relationships are useful tools for developing internally consistent cross sections in areas of suspected fault-bend folding, particularly in fold-and-thrust belts. (20 refs.)

121232 Kink folds at Upper Manitou Lake, northwestern Ontario. P.I.Wallace, P.M.Clifford (Dept. of Geology, McMaster Univ., Hamilton, Ontario, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.8, p.1305-13 (Aug. 1983).
Two sets of conjugate kink folds occur in the greenstones of Upper Manitou Lake, northwestern Ontario. One set is sparsely developed; the later set is developed over the entire area, concentrating in the neighbourhood of the Manitou Straits Fault. This second set of kink folds is asymmetrically developed and seems to be associated with sinistral movement along the fault. The mechanism of fold development involved rotation of kinked foliae between kink fold boundaries, but lateral migration of these boundaries and of the tip of the kink fold is a necessary part of the mechanism. The folds developed at relatively low confining stresses by shear along closely spaced schistosity planes. (20 refs.)

121233 Geophysical approach to the structural interpretation of the Lake Becancour region, Thetford Mines, Quebec. M.K.Seguin (Dept. de Geologie, Univ. Laval, Quebec, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.8, p.1327-39 (Aug. 1983). In French.
Gravity anomaly (Bouguer and residual) and magnetic maps of the Thetford Mines area are used to explain the mechanism by which the Lac Becancour structural unit was emplaced. The geophysical data suggest that the Lac Becancour structural unit is an old (Early Cambrian or Eocambrian) block that has undergone polyphase deformation during the Taconic Orogeny rather than being a horst-like body emplaced by vertical rise. Identical overthrust slices of Hadrynian basement in the centers of imbricated blocks and nappes of lower Paleozoic rocks are commonly observed in the Caledonides of Norway and Sweden where they generally have the appearance of antiforms or synforms. (40 refs.)

121234 Volatiles in basalts and andesites from the Galapagos Spreading Center, 85° to 86°W. C.D.Byers, D.W.Muenow, M.O.Garcia (Hawaii Inst. of Geophys., Univ. of Hawaii, Honolulu, HI, USA).
Geochim. & Cosmochim. Acta (GB), vol.47, no.9, p.1551-8 (Sept. 1983).
Glasses from submarine lavas recovered by the ALVIN submersible from the Galapagos Spreading Center near 86°W have been analyzed by electron microprobe for major elements and by high-temperature mass spectrometry for volatiles. The samples studied range in composition from basalt to andesite and are more evolved than typical MORBs. The H_2O, and F contents of these lavas are substantially higher than any previously reported for MORBs. Reduced carbon gas species, principally CH_4 and CO, were discovered in andesite glasses, perhaps indicating a more reduced oxidation state of the upper mantle than is commonly assumed. (44 refs.)

121235 Forced vibrations and integral equations of a fluid resonator. Applications to the study of fissures in the middle of rocks. J.M.Thillier, G.Fras, P.Jouanna (Lab. de Genie Civil, Univ. de Montpellier II, Montpellier, France).
Rev. Roum. Sci. Tech. Ser. Mec. Appl. (Rumania), vol.28, no.2, p.185-200 (March-April 1983). In French. [received: Sept. 1983]
An integral equation method is applied to the study of fluid filled cavities in impermeable rock. The compressible fluid is excited by a harmonic source placed down a borehole. The transfer function of the cavity is derived. The pressure variation satisfies the integral equation of the Helmholtz resonator. After discretisation of the boundaries limits are studied for the flow at the entrance of the fissure. The singular integrals are resolved using Bessel and Struve functions. A two-dimensional example is treated that corresponds to a cylindrical fissure of constant thickness inclined to the borehole. Finally, the advantages of this method are given. Comments are made on how to treat a three-dimensional problem. (7 refs.)

121236 Tobermorites: a new family of cation exchangers. S.Komarneni, D.M.Roy (Material Res.Lab., Pennsylvania State Univ., University Park, PA, USA).
Science (USA), vol.221, no.4611, p.647-8 (12 Aug. 1983).
Tobermorites have cation-exchange and selectivity properties intermediate between those of clay minerals and zeolites. Aluminum-substituted tobermorites in particular show high selectivity for cesium. This new group of cation exchangers may find applications in catalysis and in nuclear and hazardous waste disposal. (9 refs.)

121237 The development of the Beret uplift and its conjugate depressions during the Late Precambrian in the northwestern part of the Eastern Sayan region. A.S.Gibsher, A.A.Postnikov (Inst. of Geology & Geophys., Acad. of Sci., Novosibirsk, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.6, p.35-9 (1982). Translation of: *Geol. & Geofiz. (USSR)*, vol.23, no.6, p.41-6 (1982). [received: Oct. 1983]
Evidence is presented for a complicated paleotectonic structure of the area under study during the Late Precambrian, as opposed to the hitherto prevailing idea of a single Mana depression. The Beret uplift and the conjugate Zherzhul and Ust'-Mana depressions are distinguished, and their geologic history is considered. It is shown that the volcanogenic rocks of the Beret volcanic ridge are replaced by facies of sedimentary deposits in the depressions framing the ridge; this undermines the traditional idea that the three-member structure of the Kuvai series (Upper Riphean) is persistent. (17 refs.)

121238 The morphology of the gabbroid plutons and scale of basic magmatism in the Ol'khon area. M.R.Novoselova, E.Kh.Turutanov (Inst. of Earth's Crust, Acad. of Sci., Irkutsk, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.6, p.40-6 (1982). Translation of: *Geol. & Geofiz. (USSR)*, vol.23, no.6, p.46-53 (1982). [received: Oct. 1983]
The subsurface morphology and vertical extent of the newly-discovered Krestova, Ozerskii and Kuchelga plutons are determined for the first time; these plutons are confined to a single tectonic zone formed along previously, which reaches the eastern edge of Lake Baikal. (12 refs.)

121239 On the age of the basal strata of the Ordovician to Middle Devonian complex in the northwestern Altai region. N.V.Sennikov, V.D.Ermikov, Z.E.Petrunina, A.A.Puzyrev, L.G.Severgina (Inst. of Geology & Geophys., Acad. of Sci., Novosibirsk, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.8, p.51-6 (1982). Translation of: *Geol. & Geofiz. (USSR)*, vol.23, no.8, p.56-61 (1982). [received: Oct. 1983]
Considers the stratigraphic position and the interrelationships of the Lower and Middle Ordovician rocks in the Northwestern Altai region. The relationships found among these rocks make it possible to date the regional unconformity which represents a reorganization of the regional structure and a change in tectonic regime. (12 refs.)

121240 Some distinctive features of the crustal structure and metallogeny of the southern frame of the Siberian platform. L.A.Sharlovskaya (Inst. of Geology & Geophys., Acad. of Sci., Novosibirsk, USSR).
Sov. Geol. & Geophys. (USA), vol.23, no.8, p.89-95 (1982). Translation of: *Geol. & Geofiz. (USSR)*, vol.23, no.8, p.95-103 (1982). [received: Oct. 1983]
Interpretation of the geologic and geophysical data reveals extended zones of permeability that are determined by the block structure of the Earth's crust in the area of the Siberian platform's southern frame. The confinement of the alkalic magmatic rock complexes to the zones of permeability, along with their specific metallogenic profile, enables these zones to be identified with the corresponding metallogenic belts, and their reflection in the magnetic field facilitates their mapping. (20 refs.)

121241 Geology of the Moine rocks of the Loch Eil area, West Inverness-shire. R.A.Strachan.
Univ. Keele, England thesis, 1982
Detailed mapping of 120 sq. km has been carried out within the Moine rocks of the Loch Eil area, West Inverness-shire. The metasedimentary rocks of the Loch Eil Division Moine are composed of a series of psammites, quartzites and 'banded' units with minor semipelites. This sequence has been lithologically subdivided into ten lithostratigraphic units. Amphibolite facies metamorphism (M1) accompanied D1: grade was of upper to mid-amphibolite facies in the W of the Loch Eil area and declined eastwards to mid- to low-amphibolite facies. Subsequent metamorphic events (M2-M4) only involved the recrystallisation and local retrogression of M1 assemblages during metamorphism of amphibolite and greenschist facies. The Loch Eil Division lies in tectonic contact with the underlying Glenfinnan Division which, in the Loch Eil area, is composed mainly of migmatitic semi-pelitic gneiss. The Loch Eil Division has been subjected to five phases of deformation (D1-D5). The granitic gneisses and amphibolites of the Loch Eil area are considered to be meta-igneous bodies.

121242 Karst palaeoenvironments. A reconstruction with particular reference to the Morecambe Bay area. S.J.Gale.
Univ. Keele, England thesis, 1981
At least four phases of karst development can be recognised in the Morecambe Bay area of northwest England. It is possible to reconstruct the former pattern of drainage through the now-abandoned caves and to show that the caves probably date from more than one phase of hydrological development. A semi-quantitative picture of the palaeohydrology of certain karst drainage systems in the area is provided. It is also possible to reconstruct the hydraulic conditions under which former flows occurred. The surface topography of the area, previously regarded as largely a response to episodes of planation associated with falling sea levels, is studied. Finally, some of the characteristic surface karst features of the area are described, including large-scale closed depressions.

121243 Stratigraphy, sedimentology and palaeontology of the Lower Carboniferous of Anglesey. Vol.I. J.R.Davies.
Univ. Keele, England thesis, 1982
The Anglesey Dinantian succession is shown to record the establishment and growth of a land-attached carbonate platform. Underlying basement terrain and marginal terrigenoclastic accumulations are demonstrated. Palaeokarstic surfaces record the periodic lowering of sea level and the emergence of extensive areas of the limestone shelf. The sequence of numerous transgressive/regressive minor cycles is constructed.

121244 Mineralogy, petrology and geochemistry of the Serres-Drama granitic complex, northern Greece. S.Theodorikas.
Univ. Keele, England thesis, 1982
The Serres-Drama granitic complex is situated in the Rhodope massif (North Greece). It comprises a broad spectrum of rock-types (gabbro, dioritic xenoliths, monzonite, quartz monzonite, granodiorite, granite, aplite and pegmatite veins). From petrographical, mineralogical, geochemical and field studies, it can be seen that the granitic complex separates distinctly into two groups of rock-types, termed the 'intermediate' group (granite, granodiorite and quartz monzonite) and the 'basic' group (gabbro, dioritic xenoliths and monzonite). Aplites and pegmatites have not been classified in this group. The Serres-Drama granitic complex is a calc-alkaline 'I-type' complex similar to the 'magnetite' series complexes described by Ishihara (1977). Chemical characteristics indicate that it originated in the compressional zone of a mature continental arc system.

New paleomagnetic data for the Triassic Guichon batholith of south-central British Columbia and their bearing on Terrane I tectonics .... See Entry 121094

The carbonate-silicate geochemical cycle and its effect on atmospheric carbon dioxide over the past 100 million years .... See Entry 121159

Rb-Sr and U-Pb dating of bentonites .... See Entry 121163

Metamorphic and tectonic evolution of granulites, Arunta Block, central Australia .... See Entry 121172

Confirmation of the Carolina slate belt as an exotic terrane .... See Entry 121177

Tectonic thrust sheets in central Chukotka .... See Entry 121204

On the opening of a crack in rocks .... See Entry 121223

Progress of thermoluminescence research on geological materials .... See Entry 121228

Classification of Landsat data by means of color-transformations .... See Entry 121408

91.90 OTHER TOPICS IN SOLID EARTH GEOPHYSICS

121245 Rates of surface processes on slopes, slope retreat and denudation. I.Saunders (Dept. of Geography, Simon Fraser Univ., Burnaby, BC, Canada), A.Young.
Earth Surf. Processes & Landforms (GB), vol.8, no.5, p.473-501 (Sept.-Oct. 1983).
Results taken from 270 publications on rates are summarized, and collated with those from 149 publications reviewed previously (Young, 1969, 1974). The data are classified by major climatic zone, normal or steep relief, and consolidated or unconsolidated rocks. Representative rates and their ranges are given for soil creep, solifluction, surface wash, solution (chemical denudation), rock weathering, slope retreat, cliff (free face) retreat, marine cliff retreat, and denudation, the last being compared with representative rates of uplift. (63 refs.)

121246 Ground failure along the New River caused by the October 1979 Imperial Valley earthquake sequence. T.H.Heaton (Seismological Lab., California Inst. of Technol., Pasadena, CA, USA), J.G.Anderson, P.T.German.
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1161-71 (Aug. 1983).
Recognizes a number of ground failures along the south bank of the New River north of Brawley, California, following the 15 October 1979 Imperial Valley, California, earthquake sequence. The zone includes a large pond and numerous sand boils, apparently caused by liquefaction, near the Del Rio Country Club. These ground failures, together with failures at the New River bridge west of Brawley and at Wiest Lake, form a discontinuous zone 10 km long. While this zone appears to coincide with the aftershocks following the 16 October 1979, M_L 5.8, Brawley earthquake (the largest aftershock of the Imperial Valley earthquake), a cause and effect relationship cannot be demonstrated. No evidence of tectonic surface faulting could be found. (5 refs.)

121247 Haughton impact structure: structural and morphological aspects. P.B.Robertson (Earth Phys. Branch, Dept. of Energy, Mines & Resources, Ottawa, Ontario, Canada), J.F.Sweeney.
Can. J. Earth Sci. (Canada), vol.20, no.7, p.1134-51 (July 1983).
Haughton is a complex meteorite impact structure of Tertiary age on Devon Island in the Canadian Arctic. The 20.5 km diameter site was formed in essentially flat-lying Paleozoic carbonates, roughly 1700 m in thickness, overlying Precambrian gneisses. The structure comprises three concentric rings surrounding a central basin with interior peaks. The authors present a detailed description of this site. They describe the ring structure, the central peaks, circumferential and normal faulting and details of impact breccia and shatter cones. The magnetic and gravity anomalies of this feature are described. (26 refs.)

121248 Meteor Crater: historical note on nomenclature. W.G.Hoyt (Lowell Obs., Flagstaff, AZ, USA).
Meteoritics (USA), vol.18, no.2, p.159-63 (30 June 1983).
The question of the crater's name has been a subject of minor controversy for many years and, in the earlier decades of the 20th century, was entangled in a larger controversy over the crater's origin. Although of little scientific consequence, this lesser controversy is nonetheless of some historical interest. It is summarized in this note for the first time, supplemented by documentary material not heretofore cited in the literature pertaining to the crater. (30 refs.)

121249 Signature extension versus retraining for multispectral classification of surface mines in arid regions. J.R.Carr, C.E.Glass, R.A.Schowengerdt (Univ. of Arizona, Tucson, AZ, USA).
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.8, p.1193-9 (Aug. 1983).
Because governmental agencies are responsible for conducting mined land inventories on a regular basis, it is desirable to standardize the manipulation of the digital Landsat data for this purpose. Supervised classification of Landsat images is used to map Arizona copper mining activity in order to demonstrate the utility of these images for dynamic, regional inventories of mined lands. A set of spectral signatures derived at a single, large mining complex were extended spatially and temporally to discriminate mining activity from natural terrain features at other sites. Accurate classifications are obtained using signature extension, and, in some cases, the accuracy exceeds that obtained by retraining the classifier for individual mines. (5 refs.)

121250 Use of a chromogenic film for aerial photography of erosion features. B.E.Frazier, G.K.Hooper (Agronomy & Soils Dept., Washington State Univ., Pullman, WA, USA).
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.8, p.1211-17 (Aug. 1983).
The potential of Ilford XP1 photographic film in 35-mm format for aerial photo assessment of erosion was investigated. A wide exposure latitude (ASA 50 to ASA 1600) makes this film attractive for aerial photography where lighting conditions are variable and rapid shutter speeds are required. The film was field tested for image quality using exposures equivalent to ASA 100 to ASA 1000. Acceptable prints were obtained throughout the range ASA 100 to ASA 1000. A bar chart photographed at ASA 1000 showed separable line pairs 25.4 mm in width, equivalent to 35 line pairs/mm on the negative. Examples show that the film is useful for documenting the effects of erosion after cultivation and for measuring rills or soil slips. (5 refs.)

New generation lens systems for the Wild aviophot aerial camera system .... See Entry 118249

Continental hypsography .... See Entry 121164

A model for shoreline evolution around a river mouth .... See Entry 121209

92.00 HYDROSPHERIC AND ATMOSPHERIC GEOPHYSICS

(for marine geology and geophysics, see 91.50)

92.10 PHYSICS OF THE OCEANS

(see also 43.30 Underwater sound)

121251 Flandrian relative sea level changes in the Ythan valley, northeast Scotland. D.E.Smith (Dept. of Geography, Coventry Polytech., Coventry, England), R.A.Cullingford, C.L.Brooks.
Earth Surf. Processes & Landforms (GB), vol.8, no.5, p.423-38 (Sept.-Oct. 1983).
Relict Flandrian estuarine deposits in the Ythan valley are confined to an area in the lower valley around the present estuary. The vegetational context and age of these deposits are determined at Waterside, near the mouth of the present estuary. Here the grey silty clay accumulated as the result of a marine transgression which began in the Early Flandrian, and culminated between about 6189±95 and some time time prior to 4000±80 radiocarbon years BP. The carseland surface produced by this phase of accumulation is correlated with the Main Postglacial Shoreline elsewhere in eastern Scotland. Withdrawal of the sea from this level may have been interrupted by the formation of a lower carseland surface before present levels were reached, though this level may have been interrupted by the formation of a lower carseland surface before present levels were reached, though this is far from certain. The grey, micaceous, silty fine sand layer is dated at approximately 6850±140 radiocarbon years BP and is correlated with similar layers that may have been deposited following a storm surge. The authors conclude with some considerations on the age and distribution of the Main Postglacial Shoreline in eastern Scotland. (24 refs.)

121252 Observations of nonstationary turbulence in an estuary. K.Kawanisi, S.Yokosi (Hiroshima Univ., Hiroshima, Japan).
Bull. Fac. Eng. Hiroshima Univ. (Japan), vol.31, no.1, p.53-60 (Jan. 1983). In Japanese.
The turbulent fluctuations of velocity were measured in an estuary, using a two-component electromagnetic flowmeter. The evolution of $\langle u^2 \rangle$, $\langle w^2 \rangle$, $\langle uw \rangle$ spectra, Reynolds stresses and energy dissipation rate were estimated. The maximum value of $\langle u^2 \rangle$ spectra in the low frequency range was observed just after the ebb tide. The maximum values of $\langle u^2 \rangle$, $\langle w^2 \rangle$, $\langle uw \rangle$ spectra in the high frequency range were observed directly before the ebb tide. The Reynolds stress $-\langle uw \rangle$ was positive, while the mean velocity $\langle u \rangle$ was negative. The fluctuation of the main contribution to the Reynolds stresses was about 1 Hz. The maximum values of Reynolds stresses and energy dissipation rate were observed just before the ebb tide. (9 refs.)

121253 Abyssal characteristics of the World Ocean waters. A.W.Mantyla, J.L.Reid (Scripps Instn. of Oceanography, Univ. of California, San Diego, La Jolla, CA, USA).
Deep-Sea Res. Part A (GB), vol.30, no.8A, p.805-33 (Aug. 1983).
The abyssal characteristics of the World Ocean, including not only temperature but salinity, density, oxygen, and silica, are displayed on both maps and vertical sections to examine the origins of the waters of some of the major basins. Although the coldest waters that appear at the bottom in each of the oceans have long been known to have come from the Southern Ocean, the characteristics indicate that the major component of the abyssal waters of the World Ocean does not derive directly from the abyssal Antarctic but from the shallower Circumpolar Water. (53 refs.)

121254 A study of sub-inertial waves off the west coast of Mexico. N.Christensen,Jr., R.de la Paz V., G.Gutierrez V. (Centro de Investigacion Cientifica y de Educacion Superior de Ensenada, Ensenada, Mexico).
Deep-Sea Res. Part A (GB), vol.30, no.8A, p.835-50 (Aug. 1983).
Sea-level records from 16 stations along the west coast of Mexico reveal that events with 10-day time scales and amplitudes of 20 cm propagate northward along the Pacific mainland coast of Mexico and die off in the Gulf of California. The sea-level events have an offshore scale of <200 km, phase speed of 2 to 4 m s^{-1}, produce no net transport, and occur predominantly in summer. The characteristics are compared with those of theoretical and numerical Kelvin, shelf, and hybrid modes of coastally trapped waves. They resemble a hybrid form, part first mode internal Kelvin wave and part shelf wave. (19 refs.)

121255 Coastal currents in low latitudes (with application to the Somali and El Nino currents). S.G.H.Philander, P.Delecluse (Geophys. Fluid Dynamics Lab./NOAA, Princeton Univ., Princeton, NJ, USA).
Deep-Sea Res. Part A (GB), vol.30, no.8A, p.887-902 (Aug. 1983).
Near the equator, the directly wind-driven coastal jet along the western boundary of an ocean basin differs from its counterpart along the eastern boundary in several respects. (1) The western boundary current is more intense by an order of magnitude. (2) In the west the flow at the depth of the thermocline is still in the direction of the wind, but in the east the pressure force drives an undercurrent that is practically as strong as the surface current. (3) Variability on time scales from a week to months is much higher in the east than the west. (4) On time scales longer than a month long Rossby waves disperse the eastern boundary current westward, but the western current remains a coastal jet. (5) A relaxation of the wind causes a prompt reversal in the direction of the flow in the east but in the western region, where the current flows 'downhill', there is only a gradual deceleration. The relevance of these results to the Somali current in the western Indian Ocean and El Nino Current in the eastern equatorial Pacific Ocean is discussed. (19 refs.)

121256 On the wave number spectrum of oceanic mesoscale variability observed by the SEASAT altimeter. Lee-Lueng Fu (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
J. Geophys. Res. (USA), vol.88, no.C7, p.4331-41 (20 May 1983). [received: Oct. 1983]
Variations of sea surface height measured by the SEASAT altimeter in nearly repeat orbits during the last 24 days of the mission are used to compute the wave number spectrum of mesoscale variability in various parts of the oceans. The instrument noise level has limited the resulting oceanic spectrum to wavelengths longer than 100 km. The characteristics of the oceanic spectrum were found to be dependent on the energy level of the mesoscale variability. In the high-energy areas close to major current systems, most of the energy is contained at wavelengths longer than 250 km. At wavelengths shorter than 250 km the spectrum basically follows a k^{-5} (k is wave number) dependence. Based on the assumption of horizontal isotropy of mesoscale variability, scalar-wave number spectra of sea surface height and geostrophic kinetic energy are also presented. Dynamical implications of the spectra are discussed. (40 refs.)

121257 Global mesoscale variability from collinear tracks of SEASAT altimeter data. R.E.Cheney, J.G.Marsh (NASA/Goddard Space Flight Center, Greenbelt, MD, USA), B.D.Beckley.
J. Geophys. Res. (USA), vol.88, no.C7, p.4343-54 (20 May 1983). [received: Oct. 1983]
In 1978, during the last 25 days of the SEASAT mission, the satellite ground tracks repeated within 2.5 km every 3 days. This yielded eight to nine sets of global collinear altimeter data with a cross-track grid spacing of approximately 900 km at the equator and 600 km at mid-latitude. Such observations can reveal sea surface height variability due to dynamic ocean phenomena. The authors solved for variations due to deep-ocean mesoscale features by eliminating the longer wavelength deviations. The sea height profiles have a precision of a few centimeters, and the global variability map constructed from these data reveals a strikingly realistic view of mesoscale energetics. Maximum values of 20-40 cm rms variability are generated by meanders and eddies of five major current systems. A more significant discovery was the dominance of exceedingly small variability over vast regions of the oceans; approximately 70% of all global values were less than 5 cm. With such a low level of background noise, even some currents with relatively small sea height signatures could be detected. (68 refs.)

121258 Eddy kinetic energy in the North Atlantic from surface drifters. P.L.Richardson (Woods Hole Oceanographic Instn., Woods Hole, MA, USA).
J. Geophys. Res. (USA), vol.88, no.C7, p.4355-67 (20 May 1983). [received: Oct. 1983]
One hundred ten satellite-tracked freely drifting buoys measured velocities and trajectories of the near-surface currents in the North Atlantic. Mean velocity values and the velocity variance about the mean were calculated for different regions. A horizontal map of eddy kinetic energy was prepared on a 2°×2° grid between latitudes 20° and 55°N. Maximum eddy energy (~ 3000 cm^2 s^{-2}) coincides with the high speed Gulf Stream jet where it begins large amplitude meanders near 37°N 67°W. A tongue of high eddy energy coincides with the Stream's path eastward and around the Grand Banks into the Newfoundland Basin. The circulation in other parts of the North Atlantic are also described based on observations between 1971 and 1981. (38 refs.)

121259 Vertical dispersion of inertial waves in the upper ocean. D.M.Rubenstein (Sci. Applications Inc., McLean, VA, USA).
J. Geophys. Res. (USA), vol.88, no.C7, p.4368-80 (20 May 1983). [received: Oct. 1983]
A linear model of the vertical dispersion of near-inertial waves is developed. A porosity distribution near the bottom of the computational domain minimizes bottom reflections and simulates an ocean of infinite depth. The model is used to show that the vertical dispersion of near-inertial waves in the upper ocean may, under certain conditions, contribute significantly to the observed rapid decay of inertial oscillations in the surface layer. The kinetic energy of inertial oscillations at mid-latitudes decays with an e folding time scale of 10 days or less, when the parameter $\lambda(\mathrm{km})/N(\mathrm{cph})d(\mathrm{m})$ is less than or of the order of unity, where λ is the wavelength of the wind-generated near-inertial waves, N is the Vaisala frequency in the upper pycnocline, and d is the surface layer thickness. At the top of the pycnocline the model predicts a velocity maximum, which develops as energy propagates downward, out of the surface layer. (16 refs.)

121260 The sampling variability of estimates of spectra of wind-generated gravity waves. M.Donelan (Nat. Water Res. Inst., Burlington, Ontario, Canada), W.J.Pierson.
J. Geophys. Res. (USA), vol.88, no.C7, p.4381-92 (20 May 1983). [received: Oct. 1983]
The sampling variability of spectra of wind-generated waves is tested against the predictions of the theory of waves as a stationary random quasi-Gaussian process. Both laboratory data, in which stationarity was prescribed, and field data, in which the external conditions were remarkably steady, were treated in the same way. It is demonstrated that the theory of stationary Gaussian processes provides accurate estimates of the sampling variability. For a record length of 17 min, commonly used in wave monitoring at sea, the uncertainties in the significant height and peak frequency estimates are approximately ±12% and ±5% respectively at the 90% confidence level. Furthermore, the height of the peak of the spectrum is generally overestimated. (17 refs.)

121261 SEASAT synthetic aperture radar observations of wave-current and wave-topographic interactions. G.A.Meadows, R.A.Shuchman, Y.C.Tseng, E.S.Kasischke (Environmental Res. Inst. of Michigan, Ann Arbor, MI, USA).
J. Geophys. Res. (USA), vol.88, no.C7, p.4393-406 (20 May 1983). [received: Oct. 1983]
This study investigated the capability of a spaceborne, imaging radar system to detect subtle changes in the propagation characteristics of ocean wave systems. Specifically, an evolving surface gravity wave system emanating from Hurricane Ella and propagating toward Cape Hatteras, North Carolina, formed the basis of this investigation. This wave system was successfully imaged by the SEASAT synthetic aperture radar (SAR) during revolution 974 on September 3, 1978. Estimates of the dominant wavelength and direction of the ocean waves were derived from the SAR data by using optical Fourier transforms. Favorable agreement was found between wave rays calculated by utilizing theoretical wave-current and wave-topographic interactions and SAR observed dominant wavelength and direction changes across the Gulf Stream and continental shelf. (32 refs.)

121262 Imaging radar observations of directional properties of ocean waves. W.McLeish, D.B.Ross (Atlantic Oceanographic & Meteorological Labs., NOAA, Miami, FL, USA).
J. Geophys. Res. (USA), vol.88, no.C7, p.4407-19 (20 May 1983). [received: Oct. 1983]
The present work attempts to derive some properties of hurricane-generated ocean waves from radar measurements without a full knowledge of the transfer relationship. A procedure of presenting the radar spectra as directional distributions that are interpreted within a number of restrictions has been developed. Both side-looking real aperture airborne radar (SLAR) and satellite synthetic aperture radar (SAR) images were analyzed. The SLAR results were tested in part against reference wave measurements. The reference data available did not furnish directional distributions of wave energy adequate to evaluate fully those from the SLAR. A more critical test of the radar results has been a comparison of SAR wave imagery with the unique wind patterns within a hurricane. In this case, the radar-derived directional distributions could be related to the generating wind fields in some detail. In addition, the radar images showed some further directional properties of a swell as it spread across the ocean surface. (33 refs.)

121263 Wave-current interactions on a slowly varying topography. P.L.-F.Liu (School of Civil & Environmental Engng., Cornell Univ., Ithaca, NY, USA).
J. Geophys. Res. (USA), vol.88, no.C7, p.4421-6 (20 May 1983). [received: Oct. 1983]
A parabolic approximation formulation is presented to study the wave-current interactions on a slowly varying topography. Model equations are first derived

from the mild-slope assumption. A parabolic approximation is then applied to convert a boundary value problem to an initial value problem. Several limiting cases are discussed. Numerical examples are given for the case concerning the interactions between jet-like currents and normal incident waves on a sloping beach (Arthur, 1950). (15 refs.)

121264 Observations of near-surface currents and temperature in the central and western tropical Atlantic Ocean. R.L.Molinari (Atlantic Oceanographic & Meteorological Labs., NOAA, Miami, FL, USA).
J. Geophys. Res. (USA), vol.88, no.C7, p.4433-8 (20 May 1983). [received: Oct. 1983]
Eleven satellite-tracked drifting buoys were deployed in the central South Atlantic Ocean during two austral summer and two austral winter cruises. Between 7°S and 11°S and 23°W and 31°W during austral winter, net buoy drift was to the west. Surface geostrophic flow was to the east between 7°S and 9°S. It is proposed that strong southeast trade winds can induce directly driven surface flows to the west that are more intense than the eastward geostrophic flows associated with the South Equatorial Countercurrent (SECC). The North Brazilian Coastal Current, the Brazil Current and the North Equatorial Countercurrent were also studied. Temperature data obtained as the buoys drifted westward and northward suggest that increases in upper layer heat content can be attributed to heat fluxes through the sea surface. (18 refs.)

121265 Variability of current, temperature, and bottom pressure across the West Florida continental shelf, winter 1981-1982. G.O.Marmorino (Dept. of Oceanography, Florida State Univ., Tallahassee, FL, USA).
J. Geophys. Res. (USA), vol.88, no.C7, p.4439-57 (20 May 1983). [received: Oct. 1983]
Observations are analyzed from four current meter moorings deployed on the broad continental shelf in the northeastern Gulf of Mexico from November 29, 1981, to February 8, 1982. Consistent with recent modeling studies, the shelf circulation responds within an inertial period to the alternating up-and-down-coast synoptic scale wind forcing. Average response to a 0.5 dyn cm^{-2} alongshore wind stress is ~20 cm s^{-1} off Cedar Key and ~40 cm s^{-1} in the north where the shelf narrows. Lower layer currents veer counterclockwise with depth, as in a bottom Ekman layer. The pressure field decays offshore and yields a geostrophic current in good agreement with the observed alongshelf flow. Cross-shelf and vertical variations of the tidal signals compare nicely with results from barotropic theory. Calculations indicate that most of the shoreward propagating tidal energy must be dissipated in depths of <20 m. (36 refs.)

121266 Nonlinear features of internal waves off Baja California as observed from the SEASAT imaging radar. J.R.Apel, F.I.Gonzalez (Environmental Res. Labs., NOAA, Seattle, WA, USA).
J. Geophys. Res. (USA), vol.88, no.C7, p.4459-66 (20 May 1983). [received: Oct. 1983]
The synthetic aperture radar (SAR) on SEASAT has yielded well-defined images of quasi-periodic internal waves in the waters on the west side of Baja California. These waves occur in groupings separated by 15-23 km, each group having 2-20 striations with wavelengths of the order of 300 m or longer. They appear in water approximately 200 m deep, shoreward of several banks at the continental shelf edge whose depths are as shallow as 15 m. The wave surface signatures exhibit clear nonlinear features: higher-than-linear group velocities, and decreases in wavelength, crest length, and amplitude toward the rear of the packet. The observations indicate that stratification, wind speed, tidal current, and bottom topography apparently combine to establish proper conditions for tidal generation of internal waves. The images have been analyzed from the standpoint of nonlinear wave theory. (24 refs.)

121267 Physical/biological structure and exchange across the thermohaline shelf/slope front in the New York Bight. R.W.Houghton, J.Marra (Lamont-Doherty Geological Obs., Columbia Univ., Palisades, NY, USA).
J. Geophys. Res. (USA), vol.88, no.C7, p.4467-81 (20 May 1983). [received: Oct. 1983]
During the summer, the shelf/slope water in the New York Bight is thermohaline with strong temperature and salinity gradients occurring on isopycnals connecting shelf and slope water. The dominant lateral exchange is via slope water intrusions above and below the cold pool, a remnant of winter-mixed shelf water. These intrusions create environments favorable for double-diffusive processes. However, measured values of the density ratio R_ρ over the shelf imply weak vertical mixing ($K_\nu \sim 10^{-1}$ cm^{-1}), which is consistent with heat and salt fluxes into the persistent cold pool. Convergent circulation driven by cabbeling and vertical mixing enhanced by double-diffusion at the outer edge of the cold pool may be responsible for the abrupt deepening of the chlorophyll *a* maximum layer. (56 refs.)

121268 Measurements of subtidal flow in the Lesser Antilles passages. P.A.Mazeika, T.H.Kinder, D.A.Burns (Naval Ocean Res. & Dev. Activity, NSTL Station, MS, USA).
J. Geophys. Res. (USA), vol.88, no.C7, p.4483-8 (20 May 1983). [received: Oct. 1983]
During 1977 the authors obtained current meter records for up to 284 days' length in the two southernmost passages of the Lesser Antilles, St. Vincent Passage, and Grenada Passage. The sub-inertial velocity variances accounted for 15-77% of the total record variances and the amplitudes of these sub-inertial fluctuations were similar to record means. The deepest current meters (25-150 m above bottom) had oscillations of about a 14 day period, whereas shallower current meters (greater than 400 m above bottom) were dominated by fluctuations with greater than 30 day periods. (17 refs.)

121269 Atmosphere-sea ice interactions in the Beaufort/Chukchi Sea and in the European sector of the Arctic. R.G.Crane (Dept. of Geography, Univ. of Colorado, Boulder, CO, USA).
J. Geophys. Res. (USA), vol.88, no.C7, p.4505-23 (20 May 1983). [received: Oct. 1983]
Electrically Scanning Microwave Radiometer (ESMR) data for 'winter' months, November 1973 to April 1974, and for 'summer', May to October 1974, are used to examine the synoptic scale sea ice-atmosphere interactions over the Beaufort/Chukchi Sea and the European sector of the Arctic. The synoptic scale variability in the microwave brightness temperatures and sea level atmospheric pressure and temperature is examined through the use of principal components analysis. Changes occurring in the ice ablation season are found to be responsible for much of the variance in the data. Canonical correlations are used to derive the leads to lags in the ice-atmosphere system. Positive feedbacks are identified between the ice and the atmosphere, and the direction of the ice-atmosphere forcing is found to vary both seasonally and regionally, and also between the areas of permanent pack and the seasonal sea ice zone. (29 refs.)

121270 Determining the form drag contribution to the total stress of the atmospheric flow over ridged sea ice. S.M.Joffre (Inst. of Marine Res., Helsinki, Finland).
J. Geophys. Res. (USA), vol.88, no.C7, p.4524-30 (20 May 1983). [received: Oct. 1983]
Profile measurements from a meteorological mast installed in the middle of a sea ice floe in the Bothnian Bay allowed the skin roughness parameter and drag to be computed. Radiosonde and pibal profiles at the same location enabled the large-scale stress and roughness parameter to be estimated by the geostrophic departure method. The generally significant form drag contribution appears to depend also on thermal stability. These results are compared with the predictions from a model of Arya (1975) as a function of sea ice surface features statistics. The qualitive agreement is good, but uncertainty in the numerical values is considerable. (17 refs.)

121271 On the response of a wind-driven current over a continental shelf. E.Maeland (Seismological Obs., Univ. of Bergen, Bergen, Norway).
J. Geophys. Res. (USA), vol.88, no.C7, p.4534-8 (20 May 1983). [received: Oct. 1983]
The response of a coastal current forced by a steady wind stress over a sloping continental shelf is investigated. A Laplace transform technique is used, and it is shown that in the adjustment to a steady state the response consists of a damped, propagating disturbance, carrying energy offshore and longshore. This may be associated with shelf waves, but the response is not related to any poles of the image function. The spectrum is continuous, and a discrete set of 'normal modes' does not exist. (9 refs.)

121272 Low-frequency current and temperature variability from Gulf Stream frontal eddies and atmospheric forcing along the southeast US outer continental shelf. T.N.Lee (School of Marine & Atmospheric Sci., Univ. of Miami, Miami, FL, USA), L.P.Atkinson.
J. Geophys. Res. (USA), vol.88, no.C8, p.4541-67 (30 May 1983). [received: Oct. 1983]
Low-frequency current and temperature time series from the outer shelf between Cape Canaveral, Florida, and Cape Romain, South Carolina, are compared with shipboard hydrographic data, satellite VHRR, coastal and buoy winds, and coastal sea level during the period from February to June 1980. Low-frequency current and temperature variability along the shelf break was primarily produced by cyclonic, cold core Gulf Stream frontal eddies. These disturbances traveled to the north at speeds of 50 to 70 cm s^{-1} with periods of 5 to 9 days and produced cold cyclonic perturbations of the northward mean flow and temperature fields over an along-shelf coherence scale of 100 km. Frontal eddies appear to be an important mechanism in the observed eastward transport of northward momentum and heat along the shelf edge. Cold core upwelling and barotropic along-shelf current oscillations were also studied. (41 refs.)

121273 Gulf Stream frontal statistics from Florida Straits to Cape Hatteras derived from satellite and historical data. D.B.Olson, O.B.Brown, S.R.Emmerson (Rosenstiel School of Marine & Atmospheric Sci., Miami, FL, USA).
J. Geophys. Res. (USA), vol.88, no.C8, p.4569-77 (30 May 1983). [received: Oct. 1983]
A 5 year record (1976-1980) of weekly Gulf Stream paths digitized from the US Navy Ocean Frontal Analysis is analyzed to define a mean Gulf Stream path and weekly space-time series of fluctuations about the mean between the Florida Straits and Cape Hatteras. This satellite-derived Gulf Stream frontal mean locus is used as a natural coordinate system in which NODC historical expendable bathythermograph (XBT) data is averaged to determine the mean cross stream thermal structure. The results show that the satellite-derived front, that is, the cold wall of the stream as derived from IR imagery, is in good agreement with a classical definition of the stream path. The Gulf Stream path is discussed in relationship to the bottom topography. Frontal location time series at various locations along the Gulf Stream are analyzed to generate occupation statistics and spectra for stream position. (25 refs.)

121274 Diagnostic and prognostic numerical circulation studies of the South Atlantic Bight. A.F.Blumberg, G.L.Mellor (Dynalysis of Princeton, Princeton, NJ, USA).
J. Geophys. Res. (USA), vol.88, no.C8, p.4579-92 (30 May 1983). [received: Oct. 1983]
Some of the results from a series of diagnostic and prognostic numerical simulations of the circulation in the South Atlantic Bight (SAB) are described. The numerical model developed for the study is a three-dimensional, primitive equation, time dependent, σ coordinate model with an imbedded, turbulent closure submodel which should yield realistic Ekman surface and bottom layers. An implicit numerical scheme in the vertical direction and a mode-splitting technique in time are adopted for computational efficiency. A significant portion of the paper is concerned with realistic specification of initial conditions for temperature and salinity, surface forcing, and lateral open boundary conditions. (33 refs.)

121275 Comparison of the TIROS-N satellite and aircraft measurements of Gulf Stream surface temperatures. R.Legeckis (Nat. Earth Satellite Service, Washington, DC, USA), J.M.Bane,Jr..
J. Geophys. Res. (USA), vol.88, no.C8, p.4611-16 (30 May 1983). [received: Oct. 1983]
A comparison is made between multi-channel infrared (3.7 and 11 μm) temperatures measured by the TIROS-N satellite and aircraft single channel radiometer and AXBT measurements over the Gulf Stream between Cape Hatteras and Savannah, Georgia, on November 27, 1979. After reducing the noise in the 3.7 μm TIROS-N data, a multi-channel method is used to estimate the sea surface temperatures. For a temperature band of 19 to 26°C, the estimated and AXBT measurements are in agreement within a standard error estimate of 0.5°C. A bias of 1.2°C was found between the aircraft radiometer and the AXBT measurements, and part of this bias is attributed to radiometer calibration errors. (10 refs.)

121276 On Gulf Stream variability and meanders over the Blake Plateau at 30°N. T.N.Lee (School of Marine & Atmospheric Sci., Univ. of Miami, Miami, FL, USA), E.Waddell.
J. Geophys. Res. (USA), vol.88, no.C8, p.4617-31 (30 May 1983). [received: Oct. 1983]
Current and temperature variability of the Gulf Stream at 30°N was observed with a subsurface array of current meter moorings from August 1980 to October 1981. Energetic current fluctuations in the 2-14 day period band accounted for 45-70% of the total observed variability. Flow perturbations in the cyclonic shear zone tended to have a cyclonic sense of rotation and were 180° out of phase from anticyclonic flow perturbations within the anticyclonic shear region. These fluctuations appear to result from northward propagating wave-like meanders of the Gulf Stream axis. The fluctuations do not appear to be directly related to local wind forcing. Observations of near-bottom flow on the Blake Plateau east of the Gulf Stream showed periods of prolonged southward currents lasting up to 40 days with speeds in

excess of 30 cm s^{-1}. The mean flow was also southward due to these strong events. The source of the southward flow is unknown. (32 refs.)

121277 Gulf Stream meanders off North Carolina during winter and summer 1979. D.A.Brooks (Dept. of Oceanography, Texas A&M Univ., College Station, TX, USA), J.M.Bane,Jr..
J. Geophys. Res. (USA), vol.88, no.C8, p.4633-50 (30 May 1983). [received: Oct. 1983]
Meanders produced most of the subtidal variability in the Gulf Stream off North Carolina during 1979. Recording instruments were moored in the lower half of the water column over the 200-m and 400-m isobaths for two periods of 4 months, one in the late winter and one in the late summer. In both seasons, the middepth current speed typically fluctuated between -50 cm s^{-1} and $+100$ cm s^{-1} about a 30 cm s^{-1} downstream mean. The velocity, temperature, and salinity fluctuations had a prominent weekly time scale in the winter, caused by the meandering stream. In the summer the weekly time scale was less prominent within a generally energetic 3- to 10-day period band. The observations collectively point to an upstream source of meander energy, most probably made available by an instability of the Gulf Stream. (28 refs.)

121278 Subsurface energetics of the Gulf Stream cyclonic frontal zone off Onslow Bay, North Carolina. C.A.Hood, J.M.Bane,Jr. (Marine Sci. Program, Univ. of North Carolina, Chapel Hill, NC, USA).
J. Geophys. Res. (USA), vol.88, no.C8, p.4651-62 (30 May 1983). [received: Oct. 1983]
It has been shown with the use of 4-month-long time series of velocity, temperature, and conductivity that fluctuating kinetic and potential energy was converted into kinetic and potential energy of the mean flow following a fluid particle in the subsurface Gulf Stream cyclonic frontal zone off Onslow Bay, North Carolina, during early 1979. These flux calculations represent an important step in verifying the direction, of the net cross-stream energy flux within the stream off Onslow Bay. According to an hypothesis presented for the growth and decay of Gulf Stream meanders along the continental margin of the southeastern United States, Onslow Bay is an area of decreasing meander amplitude. The direction of the energy conversion from meanders to the mean flow, determined from the authors' calculations, is consistent with this hypothesis. (37 refs.)

121279 Temperature and current variability of a Gulf Stream meander observed off Onslow Bay, August 1977. E.R.Levine (Naval Underwater Systems Center, Newport, RI, USA), J.M.Bergin.
J. Geophys. Res. (USA), vol.88, no.C8, p.4663-71 (30 May 1983). [received: Oct. 1983]
Eighteen temperature sections were obtained during August 1977 using expendable bathythermograph probes along a 110 km tract oriented perpendicular to the mean direction of the Gulf Stream off Onslow Bay. Concurrent velocity and temperature measurements were obtained beneath the Stream from an Aanderra current meter moored 48 m above the bottom (620 m depth). The measurements revealed the passage of a Gulf Stream meander with a period of approximately 5 days, vertical changes in isotherm level as large as 200 m, and a lateral meander amplitude of approximately 39 km as defined by the 16°C isotherm at 200 m. A study of the meander amplitude as a function of depth is carried out in terms of the migration of the sloping frontal surface. (22 refs.)

121280 Initial observations of the subsurface structure and short-term variability of the seaward deflection of the Gulf Stream off Charleston, South Carolina. J.M.Bane,Jr. (Dept. of Phys., Univ. of North Carolina, Chapel Hill, NC, USA).
J. Geophys. Res. (USA), vol.88, no.C8, p.4673-84 (30 May 1983). [received: Oct. 1983]
A recurring seaward deflection of the surface layer of the Gulf Stream has been observed near 32°N latitude off the coast of the southeastern United States. It has been suggested that a ridge and trough bottom feature (the so-called 'Charleston Bump') on the upper continental slope off the Georgia/South Carolina coast produces the deflection through a bottom steering effect. Present data indicate that the deflection is great enough to direct the Gulf Stream's shoreward surface thermal front to the east, and even south of east, about 70% of the time. Air-deployed expendable bathythermograph surveys have been made with sufficient coverage to provide several synoptic, three-dimensional views of the Gulf Stream's thermal frontal zone in the region between Savannah, Georgia, and Cape Hatteras, North Carolina. These views show the subsurface structure of the seaward deflection to exhibit large short-term variability. (22 refs.)

121281 Cape Romain and the Charleston Bump: historical and recent hydrographic observations. J.J.Singer (Sci. Applications Inc., Raleigh, NC, USA), L.P.Atkinson, J.O.Blanton, J.A.Yoder.
J. Geophys. Res. (USA), vol.88, no.C8, p.4685-97 (30 May 1983). [received: Oct. 1983]
A review and analysis of historical and new hydrographic data are presented for the Charleston Bump region. An area of doming isotherms is identified primarily between 31.5° and 34.5°N and the 200 and 400 m isobaths. The highest incidences of doming are found off long Bay (86%), Cape Fear (38%), and Cape Romain (25%). Evidence suggests that low salinity shelf water collects in the doming area off Long Bay in July and that seasonal fluctuations in the depth of the main thermocline layer in this area are linked to Gulf Stream transport and local winds. At times there is a gradual offshore-onshore movement of the Gulf Stream opposite Long Bay roughly following the 400 m isobath and at other times an abrupt eastward movement near 32°N. Much of the time there appears to be a direct seasonal relationship between historical seasonal velocity fields and offshore deflection. (81 refs.)

121282 Distribution of Antarctic Intermediate Water over the Blake Plateau. L.P.Atkinson (Skidaway Inst. of Oceanography, Savannah, GA, USA).
J. Geophys. Res. (USA), vol.88, no.C8, p.4699-704 (30 May 1983). [received: Oct. 1983]
During a cruise in September 1980 over the Blake Plateau the author observed a northward spread of Antarctic Intermediate Water (AAIW) in the main axis of the Gulf Stream. The AAIW appeared as a lobe less than 60 km wide extending to at least 31°N. The lobe was characterized by negative salinity anomalies of 0.15×10^{-3}, elevated nutrient concentrations, and lowered oxygen concentrations. Tentative evidence suggests that a parcel of AAIW was located over the central Blake Plateau, and geostrophic calculations indicate it may have been attached to the main Gulf Stream deep flow. (27 refs.)

121283 Climatology of the southeastern United States continental shelf waters. L.P.Atkinson (Skidaway Inst. of Oceanography, Savannah, GA, USA), T.N.Lee, J.O.Blanton, W.S.Chandler.
J. Geophys. Res. (USA), vol.88, no.C8, p.4705-18 (30 May 1983). [received: Oct. 1983]
Data from 2872 hydrographic stations have been used to determine the oceanographic climatology of the southeastern United States continental shelf waters. The data were sorted by each degree of latitude and by depth into three zones (0-20 m, 21-40 m, 41-60 m). Inner shelf water temperatures were similar to adjacent land air temperatures, while outer shelf temperatures were moderated by the Gulf Stream. Minimum and maximum water temperatures occurred in Georgia and South Carolina inner shelf water. Bottom temperatures were unusually low off Florida in the summer probably because of shelf break upwelling. Surface salinity was lowest adjacent to the rivers and reached minima in the spring at the time of high runoff. Heat flow values and bulk stratification estimates are presented. (36 refs.)

121284 Nearshore coastal currents on the South Carolina continental shelf. F.B.Schwing (Skidaway Inst. of Oceanography, Savannah, GA, USA), B.Kjerfve, J.E.Sneed.
J. Geophys. Res. (USA), vol.88, no.C8, p.4719-29 (30 May 1983). [received: Oct. 1983]
Simultaneous current, sea level, wind, and atmospheric pressure data from the South Carolina nearshore shelf during the summer are analyzed and compared. The current record was taken in the nearshore region at 10 m depth, an area where the current regime has not been well studied. Most of the variance in the series is concentrated in two frequency bands: (1) 2-12 days (meteorological) and (2) 12-25 hours (tidal and daily). The variance of the two bands is approximately equal in both the alongshore and the cross-shore current compoennts, but net flow is primarily due to low frequency events. The nearshore current flows predominantly to the northeast, possibly an Ekman response to the northerly blowing wind regime. Current reversals occur in response to frontal passages approximately every 6 days. Sea-level variability was also studied. (37 refs.)

121285 Transport and fate of river discharge on the continental shelf of the southeastern United States. J.O.Blanton, L.P.Atkinson (Skidaway Inst. of Oceanography, Savannah, GA, USA).
J. Geophys. Res. (USA), vol.88, no.C8, p.4730-8 (30 May 1983). [received: Oct. 1983]
Eight years of wind and salinity data from a frontal zone in a region of the inner continental shelf off the southeastern United States have been analyzed. The changes in low-salinity water stored in the frontal zone have been parameterized by analyzing the monthly rate of change in freshwater content. When the rate of change in freshwater content was negative, the authors interpreted this as a loss of low-salinity water from the frontal zone. When this parameter was compared with seasonally averaged alongshore wind stress, the rate of loss was independent of the alongshore wind stress magnitude until threshold of about 0.1 dyne cm^{-2} was reached. Above the threshold there was a clear relationship between northward alongshore wind stress and rate of loss of freshwater from the inner shelf. (22 refs.)

121286 Anomalous refraction and conjugate solutions of finite-amplitude water waves. D.H.Peregrine, S.C.Ryrie (School of Math., Univ. of Bristol, Bristol, England).
J. Fluid Mech. (GB), vol.134, p.91-101 (Sept. 1983).
Calculations of the refraction of water waves obliquely incident on a beach indicate that in certain circumstances finite-amplitude waves are refracted to turn in a sense opposite to the refraction of linear waves. This is termed 'anomalous refraction'. It is demonstrated that similar solutions exist for a wide class of weakly nonlinear dispersive waves. When anomalous refraction solutions exist there are two 'conjugate' solutions satisfying the slowly varying wave equations. Properties of the conjugate solutions are given. Discussion of the possibility of jumps in wave properties between conjugate solutions and their relevance to refraction is in another paper (Peregrine 1983), which shows that the anomalous-refraction solution is not normally relevant on a beach. (13 refs.)

121287 Investigation of kinetics of microconvection of a water surface film. A.I.Lapshin, A.M.Trokhan.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.779-83 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR)*, vol.23, no.6, p.51-5 (Nov.-Dec. 1982). [received: Sept. 1983]
The authors present the results of laboratory investigations of surface microconvection of the special surface film or skin layer existing on the surface of water. Fluorescent dyes in conjunction with the shadow method were used. Two forms of free convection currents were observed. The usual form was a jet with a spherical lower tip and was apparently a weakly developed eddy. In addition, convection currents in the form of vertical films were formed from the convergence bands in the surface film. On the leading edge of these films weak eddies of a droplike shape were also formed. (6 refs.)

121288 On the joint distribution of wave periods and amplitudes in a random wave field. M.S.Longuet-Higgins (Dept., of Appl. Maths. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1797, p.241-58 (8 Oct. 1983).
A theoretical probability density is derived for the joint distribution of wave periods and amplitudes which has the following properties: (1) the distribution is asymmetric, in accordance with observation; (2) it depends only on three lowest moments m_0, m_1, m_2 of the spectral density function. It is therefore independent of the fourth moment m_4, which previously was used to define the spectral width (Cavanie et al. 1976). In the present model the width is defined by the lower-order parameter $\nu=(m_0M_2/m_1^2-1)^{1/2}$. The distribution agrees quite well with wave data taken in the North Atlantic (Chakrabarti and Cooley 1977) and with other data from the Sea of Japan (Goda 1978). Among the features predicted is that the total distribution of wave heights is slightly non-Rayleigh, and that the interquartile range of the conditional wave period distribution tends to zero as the wave amplitude diminished. (13 refs.)

Natural convection experiments in a triangular enclosure ......See Entry 118600

Theory of interaction of gravity waves with hydrodynamic turbulence ....See Entry 118624

The rotation of the ocean-solid Earth system ....See Entry 121088

Continental hypsography ....See Entry 121164

Sedimentary environments and postglacial history of the Fraser Delta and lower Fraser Valley, British Columbia ....See Entry 121207

Temporal variations of beam attenuation coefficient on the continental rise off Nova Scotia ....See Entry 121208

A model for shoreline evolution around a river mouth ....See Entry 121209

The solubility of calcite and aragonite in sweater at various salinities, temperatures, and one atmosphere total pressure ....See Entry 121211

An error analysis of profile flux, stability, and roughness length measurements made in the marine atmospheric surface layer ....See Entry 121314

Similarity functions in the tropical marine boundary layer .... See Entry 121316

On the relevance of two-dimensional turbulence to geophysical fluid motions .... See Entry 121320

A comparison of computed and observed insolation under clear skies over the Pacific Ocean .... See Entry 121330

Continuous mode in the theory of the barotropic instability of zonal flows .... See Entry 121336

Effect of Pleistocene glaciation upon oceanographic characteristics of the North Pacific Ocean and Bering Sea .... See Entry 121373

Multi-beam Doppler sonar observation of tidal flow turbulence .... See Entry 121391

Two-dimensional filtering with one-dimensional approach: the scanner regression-filter (SRF) .... See Entry 121409

Digital filtering of the data of sea-level survey [for earthquake prediction] .... See Entry 121412

92.20 INTERDISCIPLINARY ASPECTS OF OCEANOGRAPHY

121289 Thermodynamic properties in chemical reaction processes of seawater. H.Endo (Dept. of Appl. Phys., Nat. Defense Acad., Yokosuka, Japan), K.Shigehara.
J. Geophys. Res. (USA), vol.88, no.C7, p.4489-97 (20 May 1983). [received: Oct. 1983]
Theoretical expressions for thermodynamic parameters of the chemical reaction processes of ionic hydration in seawater are obtained by using the kinetic model of hydrated water molecules around ions in liquid water. Assuming the additivity law between the instantaneous (∞) thermodynamic quantities of electrolytes in seawater and that of the remaining nonhydrated water (i.e. free water), the relaxational (r) quantity of seawater is split from the equilibrium one (0) by subtracting the ∞ value. The quantity $(\partial T/\partial P)_{S.0}$, which may be related to potential temperature, can be divided into instantaneous and relaxation, respectively. The relaxational quantity $(\partial T/\partial P)_{S.r}$ always becomes negative, while the instantaneous one $(\partial T/\partial P)_{S.\infty}$ is always positive. Both absolute values of $(\partial T/\partial P)_S$ for r and ∞ decrease with increasing salinity and temperature, respectively. This fact is illustrated in terms of the ionic hydration. (48 refs.)

121290 Silver distributions and fluxes in north-east Pacific waters. J.H.Martin, G.A.Knauer, R.M.Gordon (Moss Landing Marine Labs., Moss Landing, CA, USA).
Nature (GB), vol.305, no.5932, p.306-9 (22 Sept. 1983).
In recent years significant knowledge has been gained about the oceanic distributions of several trace elements. However, relatively little is known about amounts of Ag in the ocean, and how this element cycles through it. The authors report that Ag levels are relatively low near the surface ($\sim$1 pmol kg^{-1}), and that concentrations more or less steadily increase with depth; for example, 23 pmol kg^{-1} at 2440 m, the deepest sample collected. In general, Ag depth profiles are similar to those observed for Cu. The near-surface cycles of Ag appears to be involved with particulate organic matter uptake-sinking-regeneration processes. (16 refs.)

121291 Dimethyl sulfide in the surface ocean and the marine atmosphere: a global view. M.O.Andreae, H.Raerndronck.
Science (USA), vol.221, no.4612, p.744-7 (19 Aug. 1983).
Dimethyl sulfide (DMS) has been identified as the major volatile sulfur compound in 628 samples of surface seawater representing most of the major oceanic ecozones. In the least three respects, its vertical distribution, its local patchiness, and its distribution in oceanic ecozones, the concentration of DMS in the sea exhibits a pattern similar to that of primary production. The global weighted-average concentration of DMS in surface seawater is 102 nanograms of sulfur (DMS) per liter, corresponding to a global sea-to-air flux of 39×10^{12} grams of sulfur per year. When the biogenic sulfur contributions from the land surface are added, the biogenic sulfur gas flux is approximately equal to the anthropogenic flux of sulfur dioxide. (31 refs.)

Relationship between pelagic tar, fluorescence and biological markers in the South Atlantic Ocean .... See Entry 120774

The solubility of calcite and aragonite in sweater at various salinities, temperatures, and one atmosphere total pressure .... See Entry 121211

Physical/biological structure and exchange across the thermohaline shelf/slope front in the New York Bight .... See Entry 121267

γ-ray spectrometric determination of uranium-series nuclides in marine phosphorites .... See Entry 121379

The instrument for the determination of dissolved oxygen in seawater .... See Entry 121410

92.40 HYDROLOGY AND GLACIOLOGY

121292 Suspended sediment in rapid subsurface stormflow on a large field plot. D.H.Pilgrim (School. of Civil Engng., Univ. of New South Wales, Kensington, NSW, Australia), D.D.Huff.
Earth Surf. Processes & Landforms (GB), vol.8, no.5, p.451-63 (Sept.-Oct. 1983).
The occurrence of rapid movement of suspended sediment in subsurface stormflow on a large field plot in California is described. Concentrations of over 1000 mgl^{-1} were recorded in storms of only low to moderate intensity. The observed sediment was composed of uniformly fine-sized particles 4 to 8 μm in diameter. The mode of transport seems different from processes previously reported. Differences in sediment concentrations in different events, levels of ^{137}Cs on the sediment, and several other types of evidence indicate that the sediment was detached and entrained at the ground surface by raindrop impact and that the water and sediment flow occurred mainly through macropores in the soil. As conditions similar to those at the study site are not uncommon, it seems probable that the phenomeon may occur in many regions. (35 refs.)

121293 Variation in cross-sectional asymmetry of coarse bedload river channels. J.A.Milne (Dept. of Geography, Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
Earth Surf. Processes & Landforms (GB), vol.8, no.5, p.503-11 (Sept.-Oct. 1983).
Alternative indices of cross-section asymmetry are compared. Observed values of two preferred indices for 567 natural sections across eleven confined upland channels are predictably low along such low sinuosity reaches. Variation in asymmetry of sections located around confined but stable, and free-migrating bends is evaluated. Consideration of the fluence of bed topography emphasizes local plan curvature of bed forms as an important control on degree of asymmetry. Variation in indices for bed forms in similar planform locations indicates the levels of asymmetry at different stages of the transformation of channel geometry over time. (12 refs.)

121294 Charts representing water budget parameters for the GDR territory. A contribution to International Hydrological Programme of the socialist countries of Europe. E.Freydank (Tech. Univ. Dresden, Dresden, Germany), H.Glander, E.Glos, G.Glugla.
Z. Meteorol. (Germany), vol.33, no.4, p.244-57 (1983). In German.
This is a report on the activities of the GDR within the International Hydrological Programme of the socialist countries of Europe for the project 'Water budget charts of central and eastern Europe' (1931 to 1960). The paper contains a description of the production of the charts for the GDR territory (scale:1:1,000,000) representing the water budget elements precipitation, evaporation and run-off including their regional and time-related distribution, and a description of the water budget in parts of the GDR and in the whole of its territory. For the first time, corrected precipitation data were used, which has resulted in higher evaporation values than were hitherto known. (14 refs.)

121295 Reflective properties from a low-velocity lake-bottom. Wei Xing-wu (Inst. of Acoustics, Acad. Sinica, Peking, China).
Acta Acust. (China), vol.8, no.3, p.179-87 (May 1983). In Chinese. [received: Oct. 1983]
Measurements of lake-bottom reflectivity for grazing angles between 7° and 90° were made using direct measuremnt in a lake. Acoustic and physical properties of the cores collected in situ were analysed in detail. It is proved that the bottom of the lake is a low-velocity sediment. A theoretical model of a four-layer fluid was built according to the cores; the layers were assumed to be homogeneous and absorbing. Theoretical computations were made using the model comparisons of theoretical and measured reflection coefficients were made at 500, 1000, 6300 and 10000 Hz, and a relatively satisfactory result was obtained. (10 refs.)

121296 ^{10}Be and Be in the Maurice River-Union Lake system of southern New Jersey. L.Lundberg, T.Ticich, G.F.Herzog, T.Hughes, G.Ashley, R.K.Moniot, C.Tuniz, T.Kruse, W.Savin.
J. Geophys. Res. (USA), vol.88, no.C7, p.4498-504 (20 May 1983). [received: Oct. 1983]
The ^{10}Be and Be contents of 22 samples taken from seven locations in the Maurice River-Union Lake system of southern New Jersey are reported. Bulk ^{10}Be contents range from 0.05 to 2.7 dpm/kg and Be from <0.1 to 2 ppm. Silicate minerals separated from Union Lake sediments appear to have a constant surface concentration of $\sim5\times10^5$ atom ^{10}Be/cm^2. Organic material is greatly enriched in Be: Hand-picked samples contain over 10 dpm/kg of ^{10}Be and 5 ppm of Be. The deposition rate of ^{10}Be in Union Lake is $\sim$1 atom/cm^{2}s. (22 refs.)

121297 Crater Lake revisited: concentration changes in water column radionuclides, 1967 to 1981. H.L.Volchok (Environmental Measurements Lab., US Dept. of Energy, New York, NY, USA), V.T.Bowen, W.R.Clark, L.R.Ball.
J. Geophys. Res. (USA), vol.88, no.C7, p.4531-3 (20 May 1983). [received: Oct. 1983]
A small-scale resampling of Crater lake water was carried out in 1981. Water from three depths (surface, 3 m, and 14 m) was obtained and analyzed for ^{3}H, ^{90}Sr, ^{137}Cs, and plutonium. The results indicate that ^{3}H and ^{90}Sr quantitatively remain in the water column and that the lake is well mixed. Twenty-five percent of the ^{137}Cs and more than 90% of the plutonium has been removed from the water column, presumably into the sediment. (14 refs.)

121298 Reduction of BOD by sedimentation in ponding zone front of a weir. A.Ichikawa, T.Nishiyama, K.Nishino (Dept. of Urban Engng., Univ. of Tokyo, Tokyo, Japan).
J. Fac. Eng. Univ. Tokyo Ser. B (Japan), vol.37, no.1, p.135-44 (March 1983). [received: Oct. 1983]
Proposes a method of the prediction and the simulation of the effect of sedimentation on flowing river water including biological oxygen demand (BOD) variations. The authors introduce the ideal settling basin theory, which is commonly applied to the water treatment works, to the analysis of actual river phenomena. This analytical method is applied to the ponding zone in front of Yotsuya-Honjuku Weir, at the middle regime of the Tama River, Japan. (5 refs.)

121299 Restoration of Norwegian lakes by reduction in sulphur deposition. R.F.Wright, A.Henriksen (Norwegian Inst. for Water Res., Oslo, Norway).
Nature (GB), vol.305, no.5933, p.422-4 (29 Sept. 1983).
Using data from a 1974-5 survey of major-ion chemistry and fish populations in 683 lakes in southern Norway, the authors predict that a 30% reduction in sulphur deposition will restore chemical conditions such that 22% of the lakes now experiencing fisheries problems should be able to support fish. (13 refs.)

121300 Modeling inland water quality using Landsat data. D.J.Carpenter (Dept. of Engng. Phys., Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia), S.M.Carpenter.
Remote Sensing Environ. (USA), vol.13, no.4, p.345-52 (Sept. 1983).
Turbidity and algal pigment concentration of freshwater lakes have been modeled and predicted using Landsat multispectral scanner data as multiple linear predictors. Satellite data for an area in South East Australia during 1978 and 1979 were used along with ground based measurements from three lakes. Date-independent models for turbidity and algal pigment were obtained using the satellite data and from one lake. The Sun elevation was included to account for differences between dates, and the time of sample collection was included to compensate for diurnal variations in pigment fluorescence. These models were used to successfully predict these water quality parameters for this lake on a new occasion and for the two other lakes on three occasions. (11 refs.)

121301 Ground water contamination in the United States. V.I.Pye (Acad. of Natural Sci., Philadelphia, PA, USA), R.Patrick.
Science (USA), vol.221, no.4612, p.713-18 (19 Aug. 1983).
Ground water contamination in the USA is of increasing concern as 50% of drinking water comes from well water. Since groundwatr moves slowly, the contaminant may affect only a small portion of an aquifer for a long period of time. The contaminant sources are discussed together with their characteristics. Remedial action and aquifer rehabilitation are discussed. Groundwater protection is also discussed. (38 refs.)

121302 Aluminium chemistry and acidification processes in a shallow podzol on the Swedish westcoast. S.I.Nilsson (Dept. of Ecology & Environmental Res., Swedish Univ. of Agricultural Sci., Uppsala, Sweden), B.Bergkvist.
Water, Air & Soil Pollut. (Netherlands), vol.20, no.3, p.311-29 (Oct. 1983).
Processes pertinent to soil acidification with special emphasis on the solution of Al were studied in three adjacent small catchments on the Swedish westcoast, with mixed coniferous forest and shallow podzols (average soil depth 50 cm). Soil solution from different depths, groundwater and streamwater were

sampled. Separation of organic and inorganic Al species was done with an ion exchange technique. The concentration of organic Al species is linearly correlated with the concentration of dissolved organic C (r^2 varied from 0.38 to 0.69 with $p<0.001$). Data are compared with other studies, both recent and older ones. The possible influence from present-day levels of H^+ and sulphurous compounds in the atmospheric deposition is evaluated. (43 refs.)

121303 An improved technique for estimating mean depth of lakes. J.M.Omernik, A.J.Kinney (Corvallis Environmental Res. Lab., US EPA, Corvallis, OR, USA).
Water Res. (GB), vol.17, no.11, p.1603-7 (1983).
Describes a technique for determining mean lake depth utilizing a systematically aligned dot grid. This technique is, on average, 55% faster than the traditional planimeter methods, depending on the type of planimeter and the size and complexity of the lake. No detectable bias is associated with results from this technique compared with those of traditional planimeter methods. The relationship $N_D = \sqrt[4]{A}$; where N_D=the number of dots falling within the shoreline of the lake and A=the surface area of the lake in ft^2, gives a quick estimation of the number of dots that should fall within the shoreline boundary of a lake for optimum sampling. (9 refs.)

121304 Search for ^{36}Sl in Stripa site groundwaters. H.Bentley (Dept. of Hydrology & Water Resources, Tucson Univ., Tucson, AZ, USA), I.Brissaud, D.Elmore, H.Gove, X.Z.Ma.
Z. Phys. A (Germany), vol.313, no.3, p.243-4 (1983).
Four groundwater samples from the Stripa site have been analysed by accelerator mass spectrometry at the University of Rochester. The ^{36}Cl concentrations were found to range from 2×10^8 to 6×10^8 atoms per litre of water, whereas the modern concentration is two orders of magnitude lower. A subsurface original seems to be the explanation of these results. (8 refs.)

Effect of localized waste-container failure on radionuclide transport from an underground nuclear waste vault .... See Entry 117620

Diffusional mass transport phenomena in the buffer material and damaged zone of a borehole wall in an underground nuclear waste vault ..... See Entry 117621

High-level waste glass field burial tests at CRNL: The effect of geochemical kinetics on the release and migration of fission products in a sandy aquifer .... See Entry 117622

Acid rain: board game to computer simulation .... See Entry 120773

Effective conductivity of anisotropic medium with large number of cracks .... See Entry 121138

Sedimentary environments and postglacial history of the Fraser Delta and lower Fraser Valley, British Columbia .... See Entry 121207

A model for shoreline evolution around a river mouth .... See Entry 121209

Forced vibrations and integral equations of a fluid resonator. Applications to the study of fissures in the middle of rocks .... See Entry 121235

The morphology of the gabbroid plutons and scale of basic magmatism in the Ol'khon area .... See Entry 121238

Karst palaeoenvironments. A reconstruction with particular reference to the Morecambe Bay area .... See Entry 121242

Ground failure along the New River caused by the October 1979 Imperial Valley earthquake sequence .... See Entry 121246

Flandrian relative sea level changes in the Ythan valley, northeast Scotland .... See Entry 121251

Transport and fate of river discharge on the continental shelf of the southeastern United States .... See Entry 121285

An attempt to estimate the depth of a snow cover using simulation models .... See Entry 121310

A description of the annual variation of the amount of precipitation .... See Entry 121311

Factors influencing the marine boundary layer during a cold-air outbreak .... See Entry 121315

Proceedings of the 26th Conference on Great Lakes Research (papers in summary form only received) .... See Entry 121378

UHF radar system for airborne surveys of ice thickness .... See Entry 121384

A new rock-magnetic approach to selecting sediments for geomagnetic paleointensity studies: application to paleointensity for the last 400 years .... See Entry 121395

Passive microwave sensing of soil moisture content: the effects of soil bulk density and surface roughness .... See Entry 121402

The instrument for the determination of dissolved oxygen in seawater .... See Entry 121410

92.60 METEOROLOGY

(see also 43.28 Aeroacoustics and atmospheric sound)

121305 The life cycle of a tornadic cloud as seen from a geosynchronous satellite. R.J.Hung (Univ. of Alabama, Huntsville, AL, USA), J.C.Dodge, R.E.Smith.
AIAA J. (USA), vol.21, no.9, p.1217-24 (Sept. 1983).
The life span of a severe storm is on the order of a few hours. Rapid-scan infrared and visible observations from geosynchronous satellites can be useful for studying the life cycle of a severe convective storm. By using artificial colors for pixels representing blackbody temperatures of the cloud top, convective storms can be observed throughout their life cycles. In this paper clouds associated with a tornadic storm, the Ringwood, Oklahoma, tornado on May 29, 1977, are compared with those without a tornadic storm to illustrate how the infrared and visible observations from a geosynchronous satellite can be used to study the differences in their life cycles. The instability of the air mass and the meteorological background are discussed based on balloon observations. (20 refs.)

121306 Rain-induced amplitude scintillation on 8.2 km line-of-sight path at 30 GHz. M.H.A.J.Herben (Dept. of Electrical Engng., Eindhoven Univ. of Technol., Eindhoven, Netherlands).
Arch. Elektron. & Uebertragungstech. (Germany), vol.37, no.9-10, p.339-40 (Sept.-Oct. 1983).
Summarises the results of an experiment, set up at the Eindhoven University, in order to measure the incoherently scattered field component. Power density spectra of the rain-induced amplitude scintillation are computed and compared with the spectra obtained from scintillation caused by tropospheric turbulence. All measurements are performed at 30 GHz on an 8.2 km line-of-sight path between Eindhoven University (receiver 44 m above local ground) and the Netherlands PTT tower in Mierlo (transmitter 77 m above local ground). The diameter of the receive and transmit antenna apertures is 0.5 m. (8 refs.)

121307 The refraction equation for the boundary layer. V.P.Sibilev.
Astrometriya & Astrofiz. (USSR), no.49, p.71-4 (1983). In Russian.
The refraction equation is deduced for the boundary layer which greatly affects formation of refraction anomalies. (5 refs.)

121308 The vorticity area index. P.C.Werner (Humboldt-Univ. zu Berlin, Berlin, Germany).
Z. Meteorol. (Germany), vol.33, no.4, p.218-25 (1983). In German.
The Vorticity Area Index (VAI), which is a measure of cyclonic activity at the 500-mb level in the northern hemisphere and which is available for 12.00 GMT from 1946 to 1975 is subjected to a time-series analysis. The annual variation of the VAI is rather conspicuous and is, in the various seasons, marked by typical features for which there are in a number of cases distinct relations to the central European weather development. The VAI is marked by a long-term variation, and an additional distinct oscillation of 2.5 and 4.3 years and of 13 to 18 days—which are in agreement with other parameters describing the circulation regime. In a number of cases the VAI exhibits a significant reaction as to a certain state of solar activity. (13 refs.)

121309 Aerodynamic conditions for planting of wind-protection belts. III. The protection effect of a woodland strip. D.Benndorf (Tech. Univ. Dresden, Dresden, Germany), K.Klingbeil, F.Grunert.
Z. Meteorol. (Germany), vol.33, no.4, p.226-33 (1983). In German.
For pt.II see ibid., vol.32, no.3, p.165-75 (1982). From wind tunnel measurements made using models with strips of varying (i.e. high and low) blocking effect and distances between the strips, the optimum distances of strip appropriate to an effective protection have been obtained. The relation of the height of strips to the given roughness of soil and to the friction layer of the up-wind air flow is of major significance. Extrapolation of the results to other conditions is feasible if a suitable distortion factor is applied. (15 refs.)

121310 An attempt to estimate the depth of a snow cover using simulation models. M.Rachner (Forschungsinst. fur Hydrometeorologie, Berlin, Germany).
Z. Meteorol. (Germany), vol.33, no.4, p.234-43 (1983). In German.
Deals with an attempt to calculate the snow depth on the basis of daily values of meteorological elements such as precipitation, air temperature, global radiation or sunshine duration. The procedure consists of conceptual models to simulate the water equivalent of the snow cover and the snow density. The results are satisfactory but several restrictions, caused by the simplicity of the models used, are taken into account. (5 refs.)

121311 A description of the annual variation of the amount of precipitation. T.Reich (Forschungsinst. fur Hydrometeorologie, Berlin, Germany).
Z. Meteorol. (Germany), vol.33, no.4, p.258-66 (1983). In German.
Shows that an harmonic analysis of the annual variation of precipitation amounts does not lead to a major reduction of the number of parameters, and compares some indices to describe the annual variation. The index published by Sver (1973) seems to be most useful to describe regional differences in the annual variability of precipitation amounts. (14 refs.)

121312 The theoretical distribution of wind in the planetary boundary layer with circular isobars. Zhao Ming (Dept. of Meteorology, Pennsylvania State Univ., University Park, PA, USA).
Boundary-Layer Meteorol. (Netherlands), vol.26, no.3, p.209-26 (July 1983).
The equations of motions are solved for concentric circular flow in the planetary boundary layer (PBL) under the assumption of $K = l^2 |\partial v / \partial z|$ and gradient wind independent of radius r. The theoretical distribution of wind is obtained for $r \geq 300$ km. Other parameters of the PBL are also calculated. Finally, equilibrium of the forces in the PBL is analyzed. (10 refs.)

121313 An all-slope 24-hour summer energy budget regime along a climatic-latitudinal transect. W.H.Terjung, P.A.O'Rourke (Dept. of Geography, Univ. of California, Los Angeles, CA, USA).
Boundary-Layer Meteorol. (Netherlands), vol.26, no.3, p.227-42 (July 1983).
A physically-based solar radiation transmission model and a slope energy budget model is used to examine the diurnally changing energy budget components of net radiation, conduction, sensible, and latent heat flux occurring at all slope angles (0 to 90 deg) and slope directions (south-, west-, and north-facing). The analysis utilized two contrasting landscapes along a latitudinal transect of the east coast of the Americas. Among the results, the maximum net radiation for all slope angles and directions occurred at noon on a 40-deg, south-facing slope for latitude 60. (15 refs.)

121314 An error analysis of profile flux, stability, and roughness length measurements made in the marine atmospheric surface layer. T.V.Blanc (Atmospheric Phys. Branch, Naval Res. Lab., Washington, DC, USA).
Boundary-Layer Meteorol. (Netherlands), vol.26, no.3, p.243-67 (July 1983).
An analytical error analysis of profile-derived fluxes of heat, moisture, and momentum along with stability and roughness length, is performed using the accuracies of the constituent temperature, humidity, and wind speed measurements. Five experiments are compared. Typical profile-method measurement errors were found to range from 15 to 35% for a sensible heat flux of ± 10 $W\ m^{-2}$, from 15 to 105% for a latent heat flux of ± 100 $W\ m^{-2}$, from 10 to 40% for a stress of 0.05 $N\ m^{-2}$, from 15 to 60% for a Monin-Obukhov stability of ± 0.05, and from 25 to 100% for a roughness length of 2×10^{-4} m. (51 refs.)

121315 Factors influencing the marine boundary layer during a cold-air outbreak. S.A.Stage (Dept. of Meteorology, Florida State Univ., Tallahassee, FL, USA).
Boundary-Layer Meteorol. (Netherlands), vol.26, no.3, p.269-87 (July 1983).
The model for the cloud-topped marine boundary layer during a cold air outbreak developed by Stage and Businger (1981) is used in conjunction with a test profile based on a fall outbreak episode over Lake Ontario to study factors influencing marine boundary-layer evolution. Sensitivity tests are done which show changes in layer evolution resulting from variation of wind speed radiative sky temperature, water surface temperature, humidity of the shoreline sounding and divergence. The behavior of the layer in the presence of a region of cold-water upwelling near the shore is also investigated. It is found that the main effect of the upwelling region is to delay modification of the boundary-layer air. (10 refs.)

121316 Similarity functions in the tropical marine boundary layer. G.K.Greenhut (NOAA Environmental Res. Labs., Boulder, CO, USA), R.R.Brook.
Boundary-Layer Meteorol. (Netherlands), vol.26, no.3, p.289-303 (July 1983).
Mean profiles of virtual potential temperature, specific humidity, and the wind velocity components are obtained from aircraft data taken during the NORPAX trans-equatorial shuttle over the Pacific Ocean. The resulting parameters are used to calculate the similarity functions A, B, C, and D. These agree well with similarity functions obtained for the tropical Atlantic Ocean using GATE data (Fitzjarrald and Garstang, 1981). The similarity function A for wind speed over the tropical oceans is in good agreement with values obtained over land at higher latitudes. the tropical temperature and humidity functions, C and D, are lower than those obtained at higher latitudes, becoming negative as $h/(-L) \to 0$. (27 refs.)

121317 The canopy coupling index of a tropical forest. R.T.Pinker (Dept. of Meteorology, Univ. of Maryland, College Park, MD, USA).
Boundary-Layer Meteorol. (Netherlands), vol.26, no.3, p.305-11 (July 1983).
During the TREND (Tropical Environmental Data) experiment conducted in Thailand wind observations were made at several levels below and above a tropical forest canopy. These data were used to compute the widely used canopy coupling index and to study its dependence on ambient conditions. The results indicate that the coupling between the above and below canopy flows depends primarily on stability and wind direction and to a lesser extent on the magnitude of the ambient wind speed. The coupling index as a function of the normalized height below the canopy was best described by exponential functions. (6 refs.)

121318 An initial assessment of pollutant dispersion by sea breezes in the Latrobe Valley. W.L.Physick (CSIRO Div. of Atmospheric Phys., Mordialloc, Australia).
Clean Air (Australia), vol.17, no.2, p.24-8 (May 1983).
The role of the sea breeze in the dispersion of pollutants has been studied in a number of localities. In this paper, the surface climatology of the Latrobe Valley sea breeze is combined with aspects of those studies to identify areas in the Valley which are likely to be affected most by sea-breeze dispersion. With the current distribution of emitters, it appears the arrival of the sea breeze may improve the air quality in all regions, although on occasions it may transport emissions to the upper part of the Valley beyond Yallourn. Details of a possible field study to further examine the ideas of this paper are presented. (12 refs.)

121319 Steady, periodic and aperiodic solutions of atmospheric flows. B.Legras (Lab. de Meteorologie Dynamique, Paris, France), M.Ghil.
J. Mec. Theor. & Appl. (France), spec, suppl., p.45-82 (1983). In French.
The authors consider the barotropic potential vorticity equation on the sphere with simplified topography spectrally truncated to 25 components. The resulting dynamical system is studied as a function of a forcing and a dissipation parameter. Stationary, periodic and aperiodic solutions are obtained which exhibit some analogies with zonal and blocked atmospheric flow regimes. The bifurcations of stationary solutions in phase space are explored systematically by a continuation method. Periodic and aperiodic regimes are studied by numerical integration of the time-dependent equations. Persistence of the different regimes and transitions between regimes are also discussed. (27 refs.)

121320 On the relevance of two-dimensional turbulence to geophysical fluid motions. J.C.McWilliams (Nat. Center for Atmospheric Res., Boulder, CO, USA).
J. Mec. Theor. & Appl. (France), spec, suppl., p.83-97 (1983).
Comparisons are made between the theory of two-dimensional turbulence and certain observed characteristics of oceanic and atmospheric flow. In practice, several generalizations of strictly two-dimensional turbulence are needed to obtain more similarities in the comparisons. These include a finite radius of deformation (γ-turbulence), nonlinear interactions between different vertical modes (baroclinic turbulence), a wave propagation mechanism (β-turbulence), variable topography and a background mean circulation (jet turbulence). Collectively, these generalizations are known as geostrophic turbulence. The observed phenomena to which comparisons are made include weather impredictability, spectrum peaks and power law regimes in horizontal and vertical wavenumber spectra, particle dispersion rates, flow near topography, and aspects of the energy budget for geophysical turbulence. (46 refs.)

121321 Some singularities and irregularities in the seasonal progression of the 700 mb height field. J.R.Lanzante (Dept. of Meteorology & Phys. Oceanography, Rutgers State Univ. of New Jersey, New Brunswick, NJ, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.967-81 (June 1983).
A climatological investigation of singularities in the seasonal progression of 5-day means of 700 mb height was undertaken for the region 30-90°N, from 160°E eastward to 0°, for the period 1947-76. A harmonic analysis is performed at each of the 127 gridpoints (10° longitude by 10° latitude spacing) in order to determine the field of deviations (for each 5-day period) between the long-term mean value and the first harmonic value (which represents the smooth seasonal progression of heights). The student's t-test is applied at each gridpoint to test whether the long-term (population) mean is significantly different from the first harmonic value. The significance of the field of t-statistics for each 5-day period is estimated. The results of the analyses described above indicate that the 700 mb height field deviates significantly from the first harmonic during several times of the year. (17 refs.)

121322 The relationship between the surface wind field and convective precipitation over the St. Louis area. G.L.Achtemeier (State Water Survey Div., Illinois Dept. of Energy & Natural Resources, Champaign, IL, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.982-99 (June 1983).
Rainfall, wind and temperature data at the surface for a mesoscale area surrounding St. Louis, Missouri for seven summer days in 1975 are used to determine qualitative and quantitative relationships between divergence, and the location, timing and intensity of rainfall. The study uses 30 prominent raincells that formed over a 1600 km^2 wind network under different synoptic and subsynoptic weather conditions. The results indicate that the physical relationships between convergence and convective rainfall over the Middle West are quite complex. Widespread convective rainfall seldom occurred in the absence of some large scale forcing. Possible forcing mechanism occurred at various levels within the troposphere and over several different space scales. On the cell scale, convergence preceded some raincells but not others. Potential mechanisms that could explain the dichotomy are investigated. (12 refs.)

121323 Specification of monthly precipitation in the western United States for monthly mean circulation. B.C.Weare, M.A.Hoeschele (Dept. of Land, Air & Water Resources, Univ. of California, Davis, CA, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.1000-7 (June 1983).
The ability to specify monthly precipitation at 36 stations in Washington, Oregon and California by various indices of monthly mean circulation is investigated. Most of the circulation indices are derived from eigenvector analyses of 700 mb geopotential height or relative vorticity for 1951-76 or 300 mb relative vorticity for 1963-76. The results indicate that an average up to 60% of the rainfall variance may be specified by same-month average circulation parameters. The 700 mb parameters analyzed within a limited domain in the vicinity of the rainfall network result in the best specification ability. Indices derived from larger domains or from the 300 mb vorticities in generally poorer specifications. (16 refs.)

121324 Hailstone growth trajectories in the dynamic evolution of a moderate hailstorm. J.-C.Grenier, P.Admirat, S.Zair (Lab. de Glaciologie, Grenoble, France).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.1008-21 (June 1983).
For the purpose of studying the growth environment of hailstones in a moderate storm, more than 200 hailstones, collected at several points along the storm path, were investigated by crystallographic and isotopic analysis. The majority of the embryos were frozen drops. The post-embryonic growth, generally observed in two growth layers, took place in a narrow range of altitudes. For six hailstones this range, inferred from isotopic data supported by a model accounting for entrainment, was between 5900 and 7100 m (−11 to −19°C). The hailstone growth trajectories are in good agreement, in space and in time, with the cell dynamic evolution derived from radar data. (21 refs.)

121325 Visual cloud histories related to first radar echo formation in northeast Colorado cumulus. C.A.Knight, W.D.Hall, P.M.Roskowski (Nat. Center for Atmospheric Res., Boulder, CO, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.1022-40 (June 1983).
Using quantitative analysis of time-lapse motion pictures from aircraft and a sensitive meteorological radar, the cloud top history is related to the early radar echo development in 12 vigorous, summer, convective cloud turrets in northeastern Colorado. At a threshold of about 5 dB(Z), the first echoes appear typically 5-10 min after the cloud top passes the −20°C level. The first echo either appears at cloud top or reaches the top very quickly. It sometimes appears at a well-defined height, but sometimes nearly simultaneously over an altitude range of 3 km or more. Radar echo at 5 dB(Z) typically fills the visual cloud 5-10 min after first echo. A detailed model of the rates of ice particle formation by vapor growth followed by riming gives a 5 dB(Z) radar echo within 7-10 min at concentrations as low as 1 m^{-3}, at most temperatures between −10 and −20°C and in cloud conditions realistic for northeast Colorado. The natural echo development may often result from the transport of embryonic ice particles into regions with vigorous updraft and high liquid water content where growth by accretion is rapid. (55 refs.)

121326 Heavy thunderstorms observed over land by the Nimbus 7 scanning multichannel microwave radiometer. R.W.Spencer (Space Sci. & Engng. Center, Univ. of Wisconsin, Madison, WI, USA), W.S.Olson, Wu.Rongzhang, D.W.Martin, J.A.Weinman, D.A.Santek.
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.1041-6 (June 1983).
In an examination of microwave data from the Nimbus 7 satellite, brightness temperatures are found that are much lower than those expected for the radiation emanating from rain-producing clouds. Every case of very cold brightness temperature coincides with heavy thunderstorm rainfall. The cold temperatures can be attributed to scattering by a layer of ice hydrometeors in the upper parts of the storms. Thus it appears that brightness temperatures observed by satellite microwave radiometers can at times distinguish heavy rain over land. (23 refs.)

121327 Diurnal radiance patterns of finite and semi-infinite clouds in observations of cloud fields. D.M.Ebel, T.B.McKee (Dept. of Atmospheric Sci., Colorado State Univ., Fort Collins, CO, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.1056-64 (June 1983).
One of the important radiative effects of cloud shape is to modify diurnal radiance patterns observed from satellites. Theory predicts a diurnal radiance pattern nearly symmetric about local noon for both semi-infinite and finite clouds situated on the equator at the equinox with a satellite directly overhead. For a geostationary satellite (SMS-1) located to the west of the cloud, the semi-infinite cloud still predicts a pattern nearly symmetric about local noon while finite cubic clouds produce a distinctly different pattern which peaks during the afternoon. Simulated diurnal satellite observations of a finite cubic and semi-infinite cloud are compared with actual diurnal satellite observations of cloud fields with cloud cover varying from less than 30% to greater than 90%. (23 refs.)

121328 Bulk parameterization of the snow field in a cloud model. Yuh-Lang Lin, R.D.Farley, H.D.Orville (Inst. of Atmospheric Sci., South Dakota School of Mines & Technol., Rapid City, SD, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.1065-92 (June 1983).
A two-dimensional, time-dependent cloud model is used to simulate a moderate intensity thunderstorm for the High Plains region. Six forms of water substance (water vapor, cloud water, cloud ice, rain, snow and hail, i.e. graupel) are simulated. The model utilizes the 'bulk water' microphysical parameterization technique to represent the precipitation fields. Accretion processes involving the various forms of liquid and solid hydrometeors are simulated. The transformation of cloud ice to snow through autoconversion (aggregation) and Bergeron processes and subsequent accretional growth or aggregation to form hail are simulated. Hail is also produced by various contact mechanisms and via probabilistic freezing of raindrops. Evaporation (sublimation) is considered for all precipitation particles outside the cloud. The melting of hail and snow are included in the model. Wet and dry growth of hail and shedding of rain from hail are simulated. The formation of virga from cloud anvils is modeled. (62 refs.)

121329 On the evaluation of wind power from short wind records. V.R.Barros, E.A.Estevan (Centro Nacional Patagonico, Consejo Nacional de Investigaciones Cientificas y Tecnicas, Chubut, Argentina).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.1116-23 (June 1983).
A method to estimate the meteorological mean wind power of a given site and year based upon data of only three months is presented. It is based on the minimization of the rms errors between observations and a representation by means of empirical orthogonal functions. These functions are calculated from a matrix formed by annual series of wind speed data from stations belonging to the same region. A numerical experiment is performed using wind series of 20 stations in the US Midwest and East. The method allows the recovery of both the mean wind speed value and its variance in a small error. The meteorological mean wind power of the year is calculated using the Weibull-II and Rayleigh probability distributions. Using the Weibull-II distribution, the method outlined above, and only 13-week observations, estimations of the true meteorological wind power is obtained. (13 refs.)

121330 A comparison of computed and observed insolation under clear skies over the Pacific Ocean. R.K.Reed (Pacific Marine Environmental Lab., NOAA, Seattle, WA, USA), R.E.Brainard.
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.1125-8 (June 1983).
In an effort to verify computational methods for ocean heat budgets, observations of insolation under clear skies for 26 days are compared with values computed by a formula previously derived from the Smithsonian Tables. The agreement between the observations and formula is within 2.0% for three groups of data over the Pacific between 10°S and 47°N. Random and systematic errors in the formula appear to be insignificant in these regions, but its validity is uncertain at higher latitudes. (9 refs.)

121331 Two-parameter empirical model for rainfall rate distribution. F.Moupfouma (CNET, Issy-les-Moulineaux, France).
Electron. Lett. (GB), vol.19, no.19, p.800-1 (15 Sept. 1983).
In a previous paper (see ibid., vol.18, p.460-1, 1982) the author suggested a three-parameter model providing a good fit for rate distribution. Moreover, this model approximates a log-normal distribution at low rates and a gamma distribution at high rates. In the letter the author reduced the number of parameters to two by setting the third one constant. This modified model appears to give good agreement with the experimental data gathered in various locations around the world. (8 refs.)

121332 Methods for forward uplink depolarization control in satellite link earth stations. M.Nouri, M.R.Braine.

GEC J. Res. Incorp. Marconi Rev. (GB), vol.1, no.1, p.59-71 (1983).

In broadcasting and fixed satellite services with point-to-multipoint or multipoint-to-point modes of operation and employing frequency re-use, it may be technically and economically advantageous to use forward uplink depolarization cancellation as a means of minimizing depolarization interference due to precipitation. A number of methods for achieving cancellation adaptively, using control devices in the feed assembly or in an auxiliary path branched from the main transmit path, have been analysed. Their performance has been evaluated under exacting conditions of open loop control and their merits are compared. All methods exhibit two degrees of freedom and as such are potentially capable of perfect uplink depolarization control for a single polarization under all prevailing atmospheric conditions. Bounds on permissible overall depolarization control error in practical implementation are also included. (18 refs.)

121333 Acetonitrile in the atmosphere. G.Brasseur, E.Arijs, A.De Rudder, D.Nevejans, J.Ingels (Belgian Inst. for Space Aeronomy, Brussels, Belgium).

Geophys. Res. Lett. (USA), vol.10, no.8, p.725-8 (1983).

The vertical distribution of acetonitrile between 0 and 55 km altitude is calculated assuming that CH_3CN is released at the Earth's surface and that the main loss process in the stratosphere is the reaction with hydroxyl radicals. The influence of different possible surface concentrations is investigated. The role of the destruction of CH_3CN by Cl, as well as the use of different eddy diffusion coefficients is briefly discussed. The results are compared with recent measurements of acetonitrile. (25 refs.)

121334 A re-evaluation of laser heterodyne radiometer ClO measurements. R.T.Menzies (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).

Geophys. Res. Lett. (USA), vol.10, no.8, p.729-32 (1983).

Previously reported measurements of stratospheric ClO using a balloon-borne laser heterodyne radiometer, launched from Palestine, Texas, are re-evaluated as a result of recent spectroscopic data. A spectral feature which was observed during September 1978 and November 1979 flights was incorrectly identified as a ClO absorption line, while a second feature observed during the latter flight with somewhat limited sensitivity is now believed to be due to ClO. This new interpretation results in a measured ClO profile which falls off more rapidly with decreasing altitude than the previous results indicated. (19 refs.)

121335 Large amplitude middle atmospheric electric fields: fact or fiction?. M.C.Kelley, C.L.Siefring, R.F.Pfaff (School of Electrical Engng., Cornell Univ., Ithaca, NY, USA).

Geophys. Res. Lett. (USA), vol.10, no.8, p.733-6 (1983).

Measurements of large apparent DC electric fields ($\sim$V/m) in the middle atmosphere made by two sounding rockets are carefully analyzed and shown to be spurious. This may shed some doubt on recent measurements of large DC electric fields by other experimenters. Evidence is presented, for one rocket, indicating that the measured electric fields are aligned with the velocity vector of the rocket. This suggests the possibility that the measured electric fields are due to a negatively charged wake. A comparison of measurements made by different electric field booms is also presented. It is seen that in one experiment insulating coatings on the booms may have affected results. It is the authors' opinion that insulating coatings should not be used at mesospheric altitudes because of possible detrimental effects such as frictional charging. (16 refs.)

121336 Continuous mode in the theory of the barotropic instability of zonal flows. M.Yamada (Dept. of Phys., Kyoto Univ., Kyoto, Japan), K.Gotoh.

J. Phys. Soc. Jpn. (Japan), vol.52, no.9, p.3039-46 (Sept. 1983).

Evolution of the two-dimensional small disturbance superimposed on a viscous parallel shear flow is investigated under the beta-plane approximation of revolution. Formal solution is obtained for an arbitrarily localized initial distribution of vorticity. The eigenfunctions of the normal mode are proved to compose a complete set. In the region where the basic flow is uniform the eigenfunction of the continuous mode behaves as the Rossby wave. The interaction between the shear and the Rossby wave is found to be an inherent character of the eigenfunction of the continuous mode. The properties of the critical latitude of the Rossby wave are attributable to those of the friction layer in the eigenfunction.

121337 Kinematics and correlation of the surface wind field in the South Atlantic Bight. R.H.Weisberg, L.J.Pietrafesa (Dept. of Marine, Earth & Atmospheric Sci., North Carolina State Univ., Raleigh, NC, USA).

J. Geophys. Res. (USA), vol.88, no.C8, p.4593-610 (30 May 1983). [received: Oct. 1983]

Surface winds observed at Charleston, South Carolina, and at an offshore buoy located some 300 km to the east of Charleston are analyzed to determine operational transformations for estimating the offshore winds from the coastal winds. Both the statistics describing the wind field at each station along with those describing the correlation between stations are found to be seasonally modulated. Ensemble averaged (by season) transfer functions computed by using the first 3 years of available data are applied to a fourth independent data year for assessing their predictive utility. The transfer functions and predictability are both seasonally modulated and the transformation matrix is nondiagonal (each offshore wind velocity component depends upon both costal components). (16 refs.)

121338 A study of structure at typhoon approach based on data on observation point—which has a purpose to construct a forecasting system of wind disaster. K.Kariya (Dept. of Electricity, Ritsumeikan Univ., Kyoto, Japan), M.Furuichi.

Mem. Res. Inst. Sci. & Eng. Ritsumeikan Univ. (Japan), no.40, p.35-56 (1981).

The future wind speed probability density distribution may be estimated or predicted from the transitions of the wind speed probability density distributions measured hourly as the typhoon approaches the observation point shows how the disaster forecast preventing the damages caused by the repetitions of the near gales and the gusts may be done. A practical approach to the study of the transitional measurement method of probability density distribution is presented. An atmospheric pressure distribution model and a wind speed distribution model of the typhoon are discussed. (18 refs.)

121339 Microwave spectroscopy of H_2O in the stratosphere and mesosphere. P.R.Schwartz (E.O. Hulburt Center for Space Res., Naval Res. Lab., Washington DC, USA), C.L.Croskey, R.M.Bevilacqua, J.J.Olivero.

Nature (GB), vol.305, no.5932, p.294-5 (22 Sept. 1983).

Ground-based microwave spectroscopy is a powerful technique for remote sensing of minor constituents, such as H_2O, in the middle atmosphere that might otherwise be difficult to measure quantitatively. The 6_{16}-$5_{23}H_2O$ transition at 22.2 GHz is particularly well suited for this application. Monitoring of the H_2O altitude profile on short and long time scales is practical and has been going on from Haystack Observatory for several years. The principal limitation of this experiment is not receiver sensitivity but, rather, baseline curvature in the receiver-spectrometer system. Baseline effects have limited the effective bandwidth of the Haystack experiments to 6.67 MHz making the effective lower altitude limit of profile inversion $\sim$50 km. They are also a dominant source of error in recovered profiles in the 50-60 km range. The authors present the first results of observations with a new receiver system developed specifically to observe atmospheric H_2O which allowed a spectrometer bandwidth of 40 MHz to be used and, thus, allowed the H_2O profile from $\sim$35 to 80 km to be recovered. (7 refs.)

121340 Chemical budgets of the stratosphere. P.J.Crutzen, U.Schmailzl (Air Chem. Div., Max-Planck-Inst. for Chem., Mainz, Germany).

Planet. & Space Sci. (GB), vol.31, no.9, p.1009-32 (1983). (European Geophysical Society Meeting on the Structure of the Upper and Middle Atmosphere, Leeds, England, 23-27 Aug. 1982).

A review is given of the stratospheric budgets of odd oxygen, odd nitrogen, nitrous oxide, methane and carbonyl sulfide. The stratospheric column production rate of NO by the reaction of $N_2O+O(^1D)=2NO$ is $1.1\text{-}1.9\times10^8$ molecules cm^{-2} s^{-1}. The stratospheric loss rates for N_2O, CH_4 and COS are equal to $0.9\text{-}1.4\times10^9$, 1×10^{10} and 0.5×10^7 molecules cm^{-2} s^{-1}, respectively. It is shown that photochemical models and available ozone observations cannot be reconciled and that there may be particularly severe problems in the 25-35 km region. Volcanic emissions of SO_2 to the stratosphere may locally lead to much enhanced ozone concentrations and heating rates. (135 refs.)

121341 The ozone budget in the stratosphere: results of a one-dimensional photochemical model. D.Cariolle (Centre Nat. de Recherches Meteorologiques, Toulouse, France).

Planet. & Space Sci. (GB), vol.31, no.9, p.1033-52 (1983). (European Geophysical Society Meeting on the Structure of the Upper and Middle Atmosphere, Leeds, England, 23-27 Aug. 1982).

The ozone concentration in the stratosphere results from the combined action of various catalytic cycles involving nitrogen oxides, HO_x and Cl_x radicals, as well as from transport processes. The results of a one-dimensional model allow the relative efficiency of those cycles to be evaluated as a function of altitude. It is found that, in the upper stratosphere, the ozone budget can be established in a straightforward manner, whereas in the lower stratosphere, chemical couplings are more complex and transport processes increasingly important. The model evaluations of the impact of chlorofluorocarbon release and nitrous oxide and methane increase on the ozone layer are also presented. (29 refs.)

121342 Ozone varability. H.U.Dutsch (Lab. for Atmospheric Phys., ETH, Zurich, Switzerland).

Planet. & Space Sci. (GB), vol.31, no.9, p.1053-64 (1983). (European Geophysical Society Meeting on the Structure of the Upper and Middle Atmosphere, Leeds, England, 23-27 Aug. 1982).

The data base for the ozone total amount and the vertical distribution is considered. On examination it becomes evident that the analysis of the global data set of relatively short duration must be combined with that of single stations with long series. The ozone content at different levels in the stratosphere is influenced by circulation patterns on different scales and thus gives different types of information. A solar cycle influence by circulation patterns on different scales and thus gives different types of information. A solar cycle influence on the ozone content in the upper stratosphere seems—if the contribution of volcanic disturbance is also taken into consideration—compatible with the observational series at Arosa. (12 refs.)

121343 Atmospheric composition: influence of biology. M.B.McElroy (Center for Earth & Planetary Phys., Harvard Univ., Cambridge, MA, USA).

Planet. & Space Sci. (GB), vol.31, no.9, p.1065-74 (1983). (European Geophysical Society Meeting on the Structure of the Upper and Middle Atmosphere, Leeds, England, 23-27 Aug. 1982).

The composition of the atmosphere is regulated by biological activity on a variety of time scales. Global biogeochemical cycles of nitrogen, carbon and sulfur are discussed with an emphasis on N_2O, NO, CO_2, CH_4, and SO_2. It is argued that Man is a major influence on the budget of these gases. His influence is attributed primarily to use of fossil fuels, to various aspects of agriculture and to the disposal of human and animal waste. (61 refs.)

121344 Influence of peroxyacetyl nitrate (PAN) on odd nitrogen in the troposphere and lower stratosphere. A.C.Aikin, J.R.Herman, E.J.R.Maier, C.J.McQuillan (Lab. for Planetary Atmospheres, NASA/Goddard Space Flight Center, Greenbelt, MD, USA).

Planet. & Space Sci. (GB), vol.31, no.9, p.1075-82 (1983). (European Geophysical Society Meeting on the Structure of the Upper and Middle Atmosphere, Leeds, England, 23-27 Aug. 1982).

Nonmethane hydrocarbon breakdown in the atmosphere produces aldehydes of which a fraction are transferred into PAN in the presence of NO and NO_2. Since ethane is destroyed photochemically primarily above 1 km, PAN can be introduced into the upper troposphere and lower stratosphere without the need to be transported from the boundary layer. At mid-latitudes the concentration of PAN below 20 km is 0.1 ppb comprable to and in some instances larger than predicted HO_2NO_2 mixing ratios. Like HO_2NO_2 and HNO_3, PAN serves as a reservoir for odd nitrogen. (41 refs.)

121345 Scattering by Pruppacher-Pitter raindrops at 30GHz. C.Yeh (Electrical Engng. Dept., Univ. of California, Los Angeles, CA, UDA), R.Woo, J.W.Armstrong, A.Ishimaru.

Radio Sci. (USA), vol.17, no.4, p.757-65 (July-Aug. 1982). [received: Oct. 1983]

Optimum design of modern ground-satellite communication systems requires knowledge of rain-induced differential attenuation, differential phase shift and cross-polarization factors. After a comprehensive assessment of different available analytical techniques, an efficient technique is chosen to yield the desired scattering results. A tabulation of the scattered fields for Pruppacher-Pitter raindrops with sizes ranging from 0.25 mm to 3.5 mm at 20°C and at 30 GHz for several incidence singles is given. (20 refs.)

121346 Remote sensing of atmospheric waves in O_2 and H_2O microwave emissions. M.El-Raey (Dept. of Phys. & Postgraduate Res. Center, Univ. of Alexandria, Alexandria, Egypt).

Radio Sci. (USA), vol.17, no.4, p.766-72 (July-Aug. 1982). [received: Oct. 1983]

Atmospheric microwave emissions from oxygen near 58.0, 54.0 and 51.0 GHz and water vapor at 22.235 GHz are monitored simultaneously at a time interval of 10 s. Power spectral analysis of radiometer output indicated frequent occurrence of enhanced emissions at periods between 3 and 13 m in. These are attributed to local buoyancy Brunt-Vaisal oscillations. Inversion of integrated brightness temperatures makes it possible to sense temperature profiles and natural wave simultaneously. Spectral analysis of microwave and/or infrared emissions, as monitored by a geostationary satellite-borne radiometer may reveal relationships between temperature profiles and natural oscillations in the Earth's atmosphere over a wide height range. (34 refs.)

121347 Analysis of rain clutter data from a frequency agile radar. W.B.Gordon (Radar Div., Naval Res. Lab., Washington, DC, USA).
Radio Sci. (USA), vol.17, no.4, p.801-16 (July-Aug. 1982). [received: Oct. 1983]
Measurements of rain clutter taken with a frequency agile *S* band radar for the purpose of studying the Doppler power spectra and the variation of backscattered power with space, time, and frequency. The clutter was found to be nonhomogeneously distributed in both space and time, but the mean backscattered power versus frequency relation seemed to involve only a single parameter having a spatial and temporal variation. A significant portion of the backscattered signal energy was always found to lie in the negative frequency range and the Doppler power spectra were sometimes found to have multiple peaks at both positive and negative Doppler frequencies. (9 refs.)

121348 Spectral parameter estimation of CAT radar echoes in the presence of fading clutter. T.Sato, R.F.Woodman (Arecibo Obs., Arecibo, Puerto Rico).
Radio Sci. (USA), vol.17, no.4, p.817-26 (July-Aug. 1982). [received: Oct. 1983]
The 430 MHz, 2 MW radar at the Arecibo Observatory is currently being used as a stratospheric-tropospheric radar. A parameter estimation technique that parameterizes the first three spectral moments corresponding to the desired stratospheric signals as well as a few Taylor series coefficients of the auto-correlation function of the clutter is presented. The three first moments can be obtained in this manner even in the presence of clutter 50 db stronger. A sequence of fine altitude and high temporal reolution wind profiles is presented, showing the potential of the instrumental and technique for the study of stratospheric dynamics. (7 refs.)

121349 Comparison of winter-nocturnal geostationary satellite infrared-surface temperature with shelter-height temperature in Florida. E.Chen, L.H.Allen,Jr., J.F.Bartholic, J.F.Gerber (Fruit Crops Dept., Univ. of Florida, Gainesville, FL, USA).
Remote Sensing Environ. (USA), vol.13, no.4, p.313-27 (Sept. 1983).
Geostationary satellite surface temperatures derived from the Visible and Infrared Spin Scan Radiometer (10.5 to 12.6 microns) were compared with 1.5-m air temperatures collected by a thermocouple on a transversing vehicle along rural highway transects in Florida, and with two fixed thermographs located in rural and agricultural areas. Statistical comparisons between satellite and 1.5-m observations yielded a mean correlation coefficient of 0.87 and an average sample standard deviation from regression of 1.57 C° during clear nights for four winters (1978-81). The satellite-temperature image of Lake Okeechobee was compared with its geographic outline for areal image registration. Manual overlays of temporal images were repeatable to within one pixel. Satellite-sensed water temperature of Lake Okeechobee was used as an indicator of satellite radiometer repeatability and stability. (14 refs.)

121350 Structures for the support of antennae. M.A.Nevot.
Rev. Telegr. Electron. (Argentina), vol.71, no.840, p.388-90, 403 (May 1983). In Spanish.
The author states that the design of antennae supports is complicated by the difficulty in forecasting the wind forces which become an important factor with very tall antennae, when analysing faults, and when building antennae in cities where risk factors must be minimised. As a result of an accident to an antenna the author doubts the reliability of certain meteorological records since the height of the antenna may not be the same as the height at which the wind speeds were recorded and since they do not indicate changes in wind speed due to the conformation of the terrain. There is also the problem of sudden gusts and the elasticity of the stay wires. Moreover the sparsity of the meteorological stations and the different methods of recording data suggest that careful revision of the standards on charts is necessary as well as full information on serious disturbances such as tornados. The author then discusses the necessity of a dynamic analysis to determine the vibration, torsion and bending to which the mast may be subjected. There is also the problem of the deterioration of the stay wires and the choice of materials not readily available. In view of these difficulties the author suggests modifications to the meteorological standards in the country. (no refs.) *G.W.*

121351 *N*-nitroso compounds: evidence for their presence in airborne particles. T.J.Kneip, J.M.Daisey, J.J.Solomon, R.J.Hershman (Inst. of Environmental Medicine, New York Univ. Medical Center, New York, NY, USA).
Science (USA), vol.221, no.4615, p.1045-7 (9 Sept. 1983).
Chemical, infrared, and thermal energy analyses have provided evidence for the presence of the N-nitroso functional group in extracts of airborne particles. The total molar N-nitroso concentrations in New York City air are equivalent to the total concentrations of polycyclic aromatic hydrocarbons. Since 90 percent of the N-nitroso compounds that have been tested are carcinogens, the newly discovered but untested materials may represent a significant environmental hazard. (19 refs.)

121352 Multiple electromagnetic wave scattering by disturbances in the inhomogeneous medium covering a caustic during inclined propagation. N.N.Zernov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.26-31 (Aug. 1983). In Russian.
The expression for the complex phase of the field based on Airey representation of the undisturbed field in the vicinity of caustic is obtained and analyzed. (5 refs.)

121353 Rainshadow—the dynamical factor. B.W.Atkinson (Queen Mary Coll. of London, London, England).
Weather (GB), vol.38, no.9, p.264-9 (Sept. 1983).
Orographical precipitation occurs over, and occasionally immediately downwind of, the relief that is its primary cause. The localisation of the precipitation distribution arises from the initiation and/or intensification of the precipitation over high ground and the relative deficit of precipitation on the downwind side. The results of this orographic effect are clearly seen on the mean rainfall map of the United Kingdom. They can also be seen occasionally on maps of precipitation drawn for much smaller time periods, but, as this note aims to show, caution must be exercised in the interpretation of maps of this kind. Clearly, if the effects of uniform frontal uplift and orography are combined, one would expect a large precipitation area (associated with the front) within which heavier precipitation occurred over hills. Conversely, if one were presented with a precipitation map showing strong localisation of precipitation over upland areas, it would be easy to conclude, perhaps erroneously, that only orographical influences had been operating. This article considers such a case by studying rainfall over Wales and southeast England. (9 refs.)

121354 A dust storm over Melbourne. R.S.Lourensz, K.Abe (Bur. of Meteorology, Sydney, Australia).
Weather (GB), vol.38, no.9, p.272-5 (Sept. 1983).
Photographs of a large dust storm over the city of Melbourne, Australia are presented. The photographs span a period of 10 minutes and were taken from the roof of a 27-storey building. The storm occurred at about 3 p.m. on 8th February 1983. The meteorological conditions responsible for the dust storm are described. The storm extended over a distance of 500 km from Mildura in north-west Victoria down to the coast at Melbourne. The visibility, attitude and dust deposition are all described. (no refs.)

121355 Unusual rains in the 1982-83 'dry' season at Khartoum. M.Hulme.
Weather (GB), vol.38, no.9, p.275-6 (Sept. 1983).
For the first time this century a measurable January fall of rain was recorded in Khartoum, the Sudan. The dry season, locally termed shita, had alredy been noticeable for the extremely low temperatures experienced. Night temperatures had on several occasions dropped below 10°C and several days had temperatures no greater than the low 20s Centigrade. 30 January started clear with blue skies but a medium height cloud bank built from the northeast during the day. At 7.30 p.m. local time a light shower was experienced in Khartoum South followed by a further one around 9.00 p.m. Thunder was heard and lightning flashes seen throughout the evening. On the succeeding three days maximum temperatures were about 25°C with humidity much higher than normal at between 50-55 per cent. Significant cloud cover remained for much of the time. Trace rainfalls were recorded on each of the three days, 31 January and 1 and 2 February. (no refs.)

121356 Das $^{18}O/^{16}O$-Verhaltnis im Julicher Niederschlag 1974-1982 und seine Korrelation mit meteorologischen und chemischen Daten (The $^{18}O/^{16}O$ ratio in the precipitation in Julich 1974-1982 and its correlation with meteorological and chemical data). H.Forstel, H.Hutzen.
Report JUL-1854, Kernforschungsanlage, Julich, Germany (June 1983), i+29 pp. In German.
From 1974 to 1982 precipitation in Julich was collected each month. The $^{18}O/^{16}O$-ratio, the pH and the concentrations of calcium, chloride and sulfate were determined. The sampling unit also collected the dry deposition. Correlation studies demonstrate that the $^{18}O/^{16}O$-ratio of precipitation can be an indicator of air temperature. Wind direction, measured near the ground, cannot be used as a tracer for the movements and dynamics of precipitation. The air temperature, possibly as a stimulator of the heating, is correlated with an increased concentration of calcium and sulfate, and a decrease of pH. A precipitation rise only dilutes the amount of ions deposited. The constancy of the $^{18}O/^{16}O$-ratio of precipitation in Julich is confirmed. (12 refs.)

121357 Fundamental limitations caused by RE propagation. R.K.Crance (Thayer School of Engng., Dartmouth Coll., Hanover, NH, USA).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.1/1-19
Atmospheric propagation phenomena affect the design of radio frequency transmission systems. They limit the suitability of portions of the frequency band for some applications, the reliability of system operation, and the density of system occupying each allocated frequency band through the possibility of interference. The suitability, reliability and possibility of interference are considered for frequencies in the range from 1 to 300 GHz. Within this range, the tropospheric processes causing attenuation by gaseous absorption and rain scatter, angle-of-arrival fluctuation, multipath, and ducting by refractive index gradients and scattering by hydrometeors are most important to the questions of suitability, reliability, and interference. (46 refs.)

121358 Medium wave groundwave propagation model—numerical and experimental results. A.F.Fer, A.Hizal (Electrical Engng. Dept., Middle East Tech. Univ., Ankara, Turkey).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.14/1-9
Two computer models incorporating two different groundwave propagation analysis techiques are investigated. The first model is a perturbation techique based on the approach by King, Maley and Wait (1966) and represents an extension of the previous results to take into account an n-section propagation path. The second model is the integral equation solution for irregular and inhomogeneous terrain based on the formulation by Ott (1979). (i.e. PROGRAM WAGNER). The results from the two approaches are compared with each other as well as the results from the Millington (1949) formula for multisection paths and knife edge diffraction for mountainous regions. Limited amount of experimental data is also compared with computed values for ground wave propagation from the Trabzon Broadcast transmitter over the Eastern Anatolian mountain ranges. Computer modelling for the study of ground wave propagation is seen to present an economically advantageous tool in the design of MF communication links. (12 refs.)

121359 A computational model for multiple knife-edge diffraction. L.E.Vogler, P.M.McManamon (Inst. for Telecommunication Sci., US Dept. of Commerce, Boulder, CO, USA).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.15/1-7
The modeling of terrain features has been limited by the difficulties in applying knife-edge diffraction theories to actual path profiles. Previous exact theory accounted for, at most, two knife-edges on a path. In this paper the derivation of a multiple knife-edge attenuation function is described. This exact multiple integral is then transformed into a series suitable for numerical evaluation. The series solution has been implemented as a computer program capable of calculating the attenuation over a path consisting of up to ten knife-edges. A comparison of theoretical attenuation calculations with observed measurements is presented for a 15-km path containing 5 knife-edges. The significance of atmospheric refractivity on multiple knife-edge diffraction is discussed, and a means of using this to provide information about the statistical distribution of propagation loss over specific paths is suggested. (8 refs.)

121360 Multiple diffusion by hydrometers: numerical simulation. N.Spanjaard, J.Lavergnat (CNET/CRPE, Issy-les-Moulineaux, France).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.19/1-6 (6 refs.)

121361 Bistatic radar reflectivities in the range 11-30 GHz. D.G.Charlton, A.R.Holt, B.G.Evans (Dept. of Math., Electrical Engng. Sci., Univ. of Essex, Colchester, England).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.20/1-9
Presents bi-static scattering cross-sections and reflectivities for the scattering of microwaves by raindrops. Compares exact results for spheroids (obtained by the Fredholm integral equation method), with exact results for spheres

(obtained using Mie theory), and approximate calculations for spheroids using Rayleigh theory. Results are given for several frequencies in the range 11-30 GHz, and for both a terrestrial and a satellite path. The Rayleigh approximation is found to give significant errors in certain cases. The results have implications for the calculation of interference between communication systems. (9 refs.)

121362 Overshoot interference on microwave radio links due to the coexistence of multipath fading and trans-horizon propagation. J.E.Doble (British Telecommunications Res. Labs., Martlesham Heath, Ipswich, England).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.21/1-7
Periods of meteorological conditions which lead to multipath effects on line-of-sight systems can also be those during which anomalous trans-horizon propagation is present. The coexistence of these two effects can give rise to increased system sensitivity to overshoot interference from one section of a microwave route into subsequent sections, or into other systems. Current overshoot interference calculations treat these two effects as uncorrelated and the degree to which this assumption is in error has been estimated from independent measurements on transhorizon links (comprising overland, oversea and mixed paths) and terrestrial links terminating in the same area. A method of estimating the probability of outage due to this cause is suggested. It makes use of the CCIR models for multipath fading and transhorizon propagation together with an empirically determined weighting factor of the order of 50 times. (1 ref.)

121363 System aspects of clear air propagation above 40 GHz. D.M.Theobold, J.D.Hopponen (Lockheed Missiles & Space Co., Sunnyvale, CA, USA).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.22/1-9
Communication links operating at frequencies above 40 GHz may be modeled using computer programs which treat both the atmosphere and communication hardware of the system in an integrated fashion. The principle mechanisms to be considered in the clear air mass are absorption by atmospheric gases and turbulence effects. Link degradations due to seasonal variations are treated. Absorption by molecular oxygen and water vapor causes dispersive signal attenuation, phase delay, and noise due to random atmospheric emission. These quantities may be predicted for specific frequency bands and atmospheric conditions by employing a computer program for ray tracing. Examples of the variation of these effects illustrate their complex dependence on atmospheric conditions and ray path elevation angle. The characteristics of the atmospheric transfer function (both amplitude and phase) are of particular importance to questions of modulation distortion in high data rate systems. The atmosphere is viewed as an additional signal filter of the communication channel and the resultant signal distortion is quantified by predicting bit error rate degradation. (4 refs.)

121364 A predictor model for EHF communication satellite system availabilities in the presence of rain. L.M.Schwab, A.J.Simmons (Lincoln Lab., MIT, Lexington, MA, USA).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.25/1-11
A computer-based tool for assessing the effect of rain attenuation upon link availability was developed to aid in selecting fundamental MILSATCOM parameters such as satellite subpoint and operating frequency as well as secondary parameters such as design margin and antenna radiation patterns. (10 refs.)

121365 Diversity reception of COMSTAR 19/29 GHz satellite beacons in convective rain climate of Florida, 1978-1981. D.Davidson, D.D.Tang (GTE Labs. Inc., Waltham, MA, USA), S.C.Bloch.
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.26/1-12
Tampa, Florida (28°N, 82.5°W), has about 90 thunderstorm days per year, nearly all in summer, dominated by events tending to occur in afternoon or early evening. Results of 19-GHz downlink rain-attenuation diversity studies involving site separations of 11, 16 and 20 km and reception at high elevation angle (about 57°), are reported for a period of 29 months, including three rainy seasons. Despite marked month-to-month differences, long-term measurements with the two larger spacings indicates that for separations above about 15 km diversity performance is not sensitive to spacing or orientation. During a fourth rainy season, using a 29-GHz beacon and the 16-km spacing, performance was similar to that predicted by scaling the 19-GHz results of the previous seasons. For rain climates like Tampa's, some form of site diversity will be required for high-reliability SHF satellite links. The diversity data may be helpful in designing schemes for resource-sharing among numbers of TDMA links. (11 refs.)

121366 Long term cross-polar statistics at 12 and 14 GHz on a 30° slant-path. R.G.Howell, J.Thirlwell, D.J.Emerson (British Telecom, Ipswich, England).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.28/1-9
Slant-path propagation measurements relevant to the design of dual-polar satellite systems are reported. The measurements were made using the Orbital Test Satellite (OTS) in conjunction with a 6.1 m off-set Cassegrain aerial located at Martlesham Heath near Ipswich (UK). Co-polar and cross-polar circularly polarised signals at a frequency of 14.5 GHz were transmitted to the satellite. These signals were down-converted to 11.8 GHz and retransmitted to the ground together with an 11.8 GHz circularly polarised beacon signals. In addition measurements were made on an 11.6 GHz linearly polarised telemetry carrier transmitted by the satellite. Cumulative statistics of the cross-polar discrimination (XPD) for the 11.6 and 11.8 GHz signals are presented and the XPD statistics for the 14.5 GHz signal estimated. The statistical significance of the depolarisation produced by high altitude ice crystals is discussed. The relationship $XPD=U-V \log CPR$ proposed by the CCIR to relate XPD to the copolar attenuation (CPA) (dB) for rain is investigated and values for U and V obtained. The dependence of depolarisation on the type of polarisation (linear compared to circular) is studied and compared with theory. (9 refs.)

121367 On combating multipath effects using spread-spectrum systems. C.P.Tou (Dept. of Electrical Engng., Tech. Univ. of Nova Scotia, Halifax, Nova Scotia, Canada).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.36/1-11
Discusses briefly the origins of multipath propagation, their effects on radio communication sysems, and schemes for suppressing these effects. Major attention is given to spread-spectrum schemes to demonstrate their capacity to combat multipath effects, to examine conditions under which the schemes would be effective, and to assess the merits of the schemes. Multipath propagation can occur under various atmospheric and geographic conditions as illustrated by simple examples. The adverse effects of multipath propagation on communication systems can be described in terms of selective fading and intersymbol interference. Simple measures can be found if the multipath propagation is predictable, but sophisticated techniques are required to combat unpredictable multipath interference. (12 refs.)

10th Annual Conference of the Association for Aerosol Research (Gesellschaft fur Aerosolforschung) See Entry 116920

European Geophysical Society Meeting on the Structure of the Upper and Middle Atmosphere See Entry 116924

AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel See Entry 116930

24th 1982 meteorological yearbook of Ispra See Entry 116936

Effective utilization of analytical instrument on measurement system—transitional measurement of amplitude probability density distribution for random fluctuation by pulse height analyzer and its application See Entry 117146

Propagation constraints in the millimetre wavebands due to precipitation scattering See Entry 118050

Solar geometry for fixed and tracking surfaces See Entry 120725

The utilizability function. I. Theoretical development of a new approach See Entry 120726

Estimates of irradiance over Zimbabwe See Entry 120727

The utilizability function. II. Validation of theory against data-based correlations See Entry 120762

An integral model for gravity spreading of heavy gas clouds See Entry 120776

Sea-breeze circulation and photochemical pollution in Athens, Greece See Entry 120777

Characterization of the transport and dispersion of pollutants in a narrow mountain valley region by means of an atmospheric tracer See Entry 120778

On the treatment of point source emissions in urban air quality modeling See Entry 120780

Aircraft observations of regional transport of ozone in the northeastern United States See Entry 120782

Size-differentiated composition of inorganic atmospheric aerosols of both marine and polluted continental origin See Entry 120785

Gas-to-particle conversion of sulfur in power plant plumes. II. Observations of liquid-phase conversions See Entry 120786

Gas-to-particle conversion of sulfur in power plant plumes. III. Parameterization of plume-cloud interactions See Entry 120787

Visibility-pollutant relationships in southern Arizona. II. A winter/summer field study See Entry 120788

Complex I and II model performance evaluation in Nevada and New Mexico See Entry 120790

A surface-corrected Gaussian model for elevated sources See Entry 120791

Comparative studies of radionuclides from global fallout and local sources in ground level air and sewage sludge See Entry 120792

The carbonate-silicate geochemical cycle and its effect on atmospheric carbon dioxide over the past 100 million years See Entry 121159

Atmosphere-sea ice interactions in the Beaufort/Chukchi Sea and in the European sector of the Arctic See Entry 121269

Determining the form drag contribution to the total stress of the atmospheric flow over ridged sea ice See Entry 121270

Dimethyl sulfide in the surface ocean and the marine atmosphere: a global view See Entry 121291

Charts representing water budget parameters for the GDR territory. A contribution to International Hydrological Programme of the socialist countries of Europe See Entry 121294

Climatology of superadiabatic conditions for a rural area See Entry 121368

Mauna Loa sky conditions—bench mark and present See Entry 121371

Investigation of the absorption of radiation emitted from a tunable CO_2 laser by water vapor in the range 9-11 μ See Entry 121372

The meteorological product: cloud analysis See Entry 121374

Terrestrial fission xenon: choice of primordial isotopic composition See Entry 121375

The young Sun and the atmosphere and photochemistry of the early Earth See Entry 121376

On the effect of interstellar gas on atmospheric oxygen and terrestrial life See Entry 121377

A long-range atmospheric tracer field test See Entry 121380

Vertical ozone profiles determined from satellite METEOR spectrometer measurements See Entry 121381

Improvements in cloud photogrammetry using airborne, side-looking, time-lapse cameras See Entry 121388

A practical approach to flux measurements of long duration in the marine atmospheric surface layer See Entry 121389

Real-time measurement of precipitation using weather radar See Entry 121390

Stratospheric temperature profile from balloon-borne measurements of the 10.4-μm band of CO_2 See Entry 121397

Relative measurement of atmospheric pressure with a Digiquartz pressure transducer and a self-registering Fortin barometer (Agari-type) See Entry 121401

Estimating surface temperatures from satellite thermal infrared data—a simple formulation for the atmospheric effect See Entry 121403

Analysis and design of a differential sunshine recorder ....See Entry 121404

Techniques for the precise estimation of hourly values of global, diffuse and direct solar radiation ....See Entry 121405

Scintillation modelling and measurement: a tool for remote-sensing slant paths ....See Entry 121413

Atmospheric sodium chemistry and diurnal variations: an up-date ....See Entry 121414

Interference and sharing at medium frequency skywave propagation considerations ....See Entry 121451

92.60S Climatology

121368 Climatology of superadiabatic conditions for a rural area. E.S.Takle (Dept. of Agronomy & Earth Sci., Iowa State Univ. of Sci. & Technol., Ames, IA, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.1129-32 (June 1983).
Temperature measurements taken over a 6-year period from a 32 m tower are used to study the climatology of low-level superadiabatic conditions in a rural area. Plots of monthly distributions of event commencement times and durations display a high degree of symmetry compared to the distributions for inversions previously published. This climatology can be used to better identify periods when spores, pollens, insects, smoke or agricultural chemical introduced at the surface will quickly become available for long-range transport by the upper level winds. (5 refs.)

The carbonate-silicate geochemical cycle and its effect on atmospheric carbon dioxide over the past 100 million years ....See Entry 121159

Some singularities and irregularities in the seasonal progression of the 700 mb height field ....See Entry 121321

Effect of Pleistocene glaciation upon oceanographic characteristics of the North Pacific Ocean and Bering Sea ....See Entry 121373

92.65 ATMOSPHERIC OPTICS

(see also 42.00 Optics)

121369 Seeing for the solar observations on the Terskol Peak. V.I.Troyan, S.N.Osipov.
Astrometriya & Astrofiz. (USSR), no.49, p.67-71 (1983). In Russian.
Seeing for the solar observations on the Terskol Peak in winter time is shown to be 2.7″. The best seeing was observed before midday. (2 refs.)

121370 Scintillation of laser radiation due to propagation through atmospheric turbulence, measurements, and theoretical calculations. C.D.V.Thomas, M.T.Clarke (Royal Armament Res. & Dev. Establ., Sevenoaks, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.557-63 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
The scintillation strength may be characterised by the parameter η, $\eta^2=0.5\ Cn^2\ K^{7/6}\ L^{11/6}$, where Cn is the turbulent refractive index constant, K is the wavenumber of the radiation, L is the range. For values of η^2 (in weak scintillation η^2 is the variance of the log irradiance) greater than 0.5, i.e. k for ranges 0.5 km for visible or near IR lasers in summer conditions the scintillation may no longer be described by the weak fluctuation theory. For medium and strong scintillation it is not at present possible to predict either the mean irradiance or the mean square irradiance fluctuations by analytical formulae. However, it is possible to obtain an integral expression for the mean irradiance I. This expression has been evaluated by numerical integration on a 1906A ICL computer. The mean square fluctuation of irradiance is more difficult to calculate, as it involves expressions for the fourth order moment of the field. In this case, it has not yet been possible to even derive closed expressions for the solution of the differential equation for the fourth moment of the field. However a number of possible numerical approaches have yielded results which compare favourably with experimental results in some cases. (4 refs.)

121371 Mauna Loa sky conditions—bench mark and present. C.J.Garcia, E.A.Yasukawa (High Altitude Obs., Nat. Center for Atmospheric Res., Boulder, CO, USA).
Publ. Astron. Soc. Pac. (USA), vol.95, no.570, p.520-6 (Aug. 1983).
Sky conditions at the Mauna Loa Solar Observatory (MLSO) were measured during a period of uncontaminated skies in July 1981, and during the presence of volcanic dust clouds in 1982 using MLSO instrument systems. A six-fold increase in scattering, due to aerosols is accompanied by a 25% direct incident radiation decrease, and sky polarization/intensity perturbations were detected after the onset of volcanic clouds. (8 refs.)

121372 Investigation of the absorption of radiation emitted from a tunable CO_2 laser by water vapor in the range 9-11 μ. V.N.Aref'ev, B.N.Pogadaev, N.I.Sizov (Inst. of Experimental Meteorology, Obninsk, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.3, p.289-92 (March 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.3, p.496-502 (March 1983). [received: Oct. 1983]
The results of measurements of the transmission of radiation emitted from a tunable CO_2 laser by the water vapor continuum in the range 9-11 μ are reported. The results for 23 laser lines are used to derive an approximate expression for the calculation of the continuous absorption of radiation by water vapor as a function of its temperature and pressure, as well as a function of the radiation wavelength and the pressure of the broadening gas. It is shown that this expression can be used to calculate the absorption of CO_2 laser radiation propagating in the atmosphere. (22 refs.)

Modified Monte-Carlo method to evaluate multiple scattering effects on light-beam transmission through a turbid atmosphere ....See Entry 118079

Visibility-pollutant relationships in southern Arizona. II. A winter/summer field study ....See Entry 120788

The refraction equation for the boundary layer ....See Entry 121307

A re-evaluation of laser heterodyne radiometer ClO measurements ....See Entry 121334

92.90 OTHER TOPICS IN HYDROSPHERIC AND ATMOSPHERIC GEOPHYSICS

121373 Effect of Pleistocene glaciation upon oceanographic characteristics of the North Pacific Ocean and Bering Sea. C.Sancetta (Lamont-Doherty Geological Obs., Columbia Univ., Palisades, NY, USA).
Deep-Sea Res. Part A (GB), vol.30, no.8A, p.851-69 (Aug. 1983).
During intervals of Pleistocene glaciation, insolation of the high-latitude northern hemisphere was lower than today, particularly during summer. Growth of continental ice sheets resulted in a lowering of sea level by more than 100 m in the Bering Sea. As a result, the Bering Strait was closed and most of the Bering continental shelf exposed. A proposed model predicts that (1) sea-ice formation would occur along the (modern) outer continental shelf, (2) advection would transport the sea ice over the deep basin, and (3) brine would flow into the basin at some intermediate depth to enhance the halocline. The result would be a low-salinity surface layer with a cold, thick halocline and reduced vertical mixing. (42 refs.)

121374 The meteorological product: cloud analysis. R.R.Warner (European Space Operations Centre, Darmstadt, Germany).
ESA Bull. (France), no.35, p.30-3 (Aug. 1983).
The cloud-analysis product is a coded representation of the cloud present in Meteosat thermal infrared and visible images, for a specific time. At present it is produced routinely, four times a day, from images close to the nominal times of 00, 06, 12 and 18 UT, but for internal reasons the results are disseminated to the meteorological community three times daily only. Up to the present time (May 1983) the product has been produced routinely for about a year and users are still in the experimental stage of its utilisation. In concept, however, it was designed principally for use in atmospheric mathematical models and for cloud climatological purposes. Other uses forseen include rainfall studies, radiative-energy-transfer studies and input to synoptic-analysis schemes. (no refs.)

121375 Terrestrial fission xenon: choice of primordial isotopic composition. L.Levsky (Inst. of Precambrian Geology, Acad. of Sci., Leningrad, USSR).
Meteoritics (USA), vol.18, no.2, p.155-8 (30 June 1983).
A new composition of primordial terrestrial xenon is derived, on the assumption that it lies on an extension of the mixing line between solar Xe and anomalous (CCF) Xe in carbonaceous chondrites. With this composition, the apparent fission components in atmospheric and well gas Xe become larger, and resemble ^{244}Pu fission xenon. (7 refs.)

121376 The young Sun and the atmosphere and photochemistry of the early Earth. V.M.Canuto (NASA, Goddard Inst. for Space Studies, New York, NY, USA), J.S.Levine, T.R.Augustsson, C.L.Imhoff, M.S.Giampapa.
Nature (GB), vol.305, no.5932, p.281-6 (22 Sept. 1983).
The origin and evolution of the Earth's early atmosphere depend crucially on the dissipation time t_N of the primitive solar nebula, SN. Using different theories of turbulence, the authors estimate that for a 0.1 $M_\odot$ SN, t_N is 2.5-8.3 Myr. Because accretion times are usually much longer, the authors conclude that most planetary accretion must have occurred in a gas-free environment. Using new IUE data, a wavelength-dependent UV flux is constructed for the young Sun which is then used to study the photochemistry and concentrations of O, O_2, O_3, OH, H, HCO and formaldehyde H_2CO in the Earth's early prebiological atmosphere. (61 refs.)

121377 On the effect of interstellar gas on atmospheric oxygen and terrestrial life. S.Yabushita, A.J.Allen (Dept. of Appl. Math., Kyoto Univ., Kyoto, Japan).
Observatory (GB), vol.103, no.1056, p.249-51 (Oct. 1983).
The disappearance of most of the very large species at the end of the Cretaceous period has led to much speculation concerning cataclysmic events which may have made the Earth uninhabitable for them. Against this are set slow, or evolutionary, processes which may allow other species to become better adapted to survival. The authors present a model which is moderately slow and causes a permanent change in the Earth's biosphere, yet is global and cataclysmic. Following McCrea (1975) and Begelman and Rees (1976), the authors treat the effect of an interstellar hydrogen cloud on the Earth, and propose that a rare passage through a dense cloud may have depleted the atmosphere's oxygen sufficiently that certain species ceased to be viable. (11 refs.)

121378 Proceedings of the 26th Conference on Great Lakes Research (papers in summary form only received).
Buffalo, NY, USA: Int. Assoc. Great Lakes Res. (1983), ix+49 pp.
Conference held at: Oswego, NY, USA. Date 23-27 May 1983. Various aspects of the Great Lakes of North America were discussed at this conference. The lakes discussed include Huron, Ontario, Erie, Michigan, Owasco, Superior, Champlain and the inland lakes of New York State. The tropics discussed include sedimentation, pollution, water quality, biological aspects, ice and climatology, fisheries and wildlife and recreational uses.

Advanced Remote Sensing ....See Entry 116914

Educational image processing: an overview ....See Entry 116939

Instructional use of a mainframe interactive image analysis system ....See Entry 116941

Digital image processing using the Apple II microcomputer ..See Entry 116942

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Rare gases from the undepleted mantle? ....See Entry 121171

Karst palaeoenvironments. A reconstruction with particular reference to the Morecambe Bay area ....See Entry 121242

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Diurnal radiance patterns of finite and semi-infinite clouds in observations of cloud fields ....See Entry 121327

Improvements in cloud photogrammetry using airborne, side-looking, time-lapse cameras ....See Entry 121388

93.00 GEOPHYSICAL OBSERVATIONS, INSTRUMENTATION, AND TECHNIQUES

93.30 INFORMATION RELATED TO GEOGRAPHICAL REGIONS

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Sea-breeze circulation and photochemical pollution in Athens, Greece ....See Entry 120777

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Forecasting peak ozone levels .... See Entry 120779

On the treatment of point source emissions in urban air quality modeling .... See Entry 120780

Aircraft observations of regional transport of ozone in the northeastern United States .... See Entry 120782

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Study of the temporal dynamics of the Manchazh regional magnetic anomaly .... See Entry 121098

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A Pennsylvanian paleomagnetic pole from the mineralized Late Cambrian Bonneterre Formation, southeast Missouri .... See Entry 121103

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Problems in study of seismotectonic deformation of rock masses .... See Entry 121195

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Some basic regularities in the seismotectonic deformation of the Kuril-Kamchatka region over 1929-1973 .... See Entry 121197

Gloria observations of the propagating rift at 95.5°W on the Cocos-Nazca spreading center .... See Entry 121200

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Martian gases in an Antarctic meteorite? ....See Entry 121637

93.55 INTERNATIONAL ORGANIZATIONS, NATIONAL AND INTERNATIONAL PROGRAMS

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93.65 DATA ACQUISITION AND STORAGE

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93.85 INSTRUMENTATION AND TECHNIQUES FOR GEOPHYSICAL RESEARCH

121379 γ-ray spectrometric determination of uranium-series nuclides in marine phosphorites. Kee Hyun Kim, W.C.Burnett (Dept. of Oceanography, Florida State Univ., Tallahassee, FL, USA).
Anal. Chem. (USA), vol.55, no.11, p.1796-800 (Sept. 1983).
A series of nondestructive γ-ray spectrometry measurements, utilizing a well-type intrinsic germanium detector, has been used to determine activities of uranium-series radionuclides in marine phosphate nodules. Two low-energy γ-ray photopeaks were used for measuring ^{238}U, three or four peaks for ^{226}Ra, and one low-energy peak for ^{210}Pb. The system was calibrated for efficiency by using both natural and synthetic calibrated standards. Agreement between the authors' γ-ray method and standard radiochemical techniques is shown to be satisfactory based on intercomparisons with previously analyzed samples and standards. The authors' results indicate that a nondestructive γ spectrometric method can often replace the more time-consuming and elaborate radiochemical techniques traditionally used in measuring low-level radioactivities in natural samples. (35 refs.)

121380 A long-range atmospheric tracer field test. M.M.Fowler (Los Alamos Nat. Lab., Los Alamos, NM, USA), S.Barr.
Atmos. Environ. (GB), vol.17, no.9, p.1677-85 (1983).
A long-range application of a heavy methane atmospheric tracer system has been carried out using both $^{12}CD_4$ and $^{13}CD_4$. The experiment had several objectives including testing a newly developed cryogenic air sampler testing a new sample handling apparatus and demonstrating the use of heavy methanes over transport distances up to 2500 km and travel times of more than 100 h. A simple diffusion estimation method applied in conjunction with trajectories produced by NOAA from upper air meteorological data yields good agreement with the tracer data on dosage and arrival time. The duration of observed tracer at the long-range stations was longer than estimated with simple concepts. (9 refs.)

121381 Vertical ozone profiles determined from satellite METEOR spectrometer measurements. U.Feister (Meteorologisches Hauptobs., Potsdam, Germany).
Z. Meteorol. (Germany), vol.33, no.4, p.197-217 (1983).
The vertical distribution of atmospheric ozone in the troposphere and stratosphere has been inferred from observations of the upward directed infrared radiance of the Earth/atmosphere system that have been made using Fourier spectrometers onboard METEOR satellites. Comparing the resulting ozone profiles with ozone profiles measured by balloon-borne ozone sondes, with tentatively removing observational errors of ozone sondes, provides estimates of the information which is contained in the calculated ozone profiles. A gain of information from the remote sensing method under consideration has been found only for the lower stratosphere. As to the information content, similar results have been obtained by applying a regression method that allows to determine vertical ozone profiles from some predictors such as vertical temperature distribution and total ozone. The latter method may be easily handled, and it consumes essentially less computer time as compared to the remote sensing method. (106 refs.)

121382 Use of lasers in hydrometeorological research and for environmental monitoring. V.M.Zakharov, V.S.Portasov, V.U.Khattatov (Central Aerological Obs., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.44, no.8, p.69-77 (1980). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.44, no.8, p.1639-50 (1980). [received: Oct. 1983] (2nd All-Union Conference on 'Laser Optics', Leningrad, USSR, Jan. 1980).
The results of the use of lasers in geological research and for determination of meteorological parameters, atmospheric-aerosol microstructure, and the gaseous composition of the atmosphere are reviewed. (15 refs.)

121383 Digitization noise and accelerograph pen offset associated with Japanese accelerograms. C.B.Crouse, T.Matuschka (ERTEC Inc., Long Beach, CA, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.4, p.1187-96 (Aug. 1983).
Ground-motion accelerograms recorded in Japan between 1956 and 1978 were recently processed. Preprocessing studies of the accelerograms are required that consist of: (1) evaluation of the long-period digitization noise in the accelerograms, and (2) correction for initial offset of the recording pen in the SMAC accelerograph. Long-period digitization noise present in each accelerogram is identified from the Fourier Amplitude Spectrum of the uncorrected accelerogram. Similar investigations with United States accelerograms recorded on 70-mm film revealed that the noise in both sets of data have similar characteristics. Correction for initial pen offset is necessary for some Japanese accelerograms because the pen arm was not parallel to the direction of movement of the recording paper. To account for pen offset, values of the initial pen rotation are assumed, and the accelerograms are corrected using a simple algorithm. (11 refs.)

121384 UHF radar system for airborne surveys of ice thickness. B.B.Narod, G.K.C.Clarke (Dept. of Geophys. & Astron., Univ. of British Columbia, Vancouver, BC, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.7, p.1073-86 (July 1983).
Describes an 840 MHz pulsed radar system developed for airborne sounding of polar glaciers and ice caps. The system performance (ratio of transmitter

power to minimum detectable signal) is 126 dB. A sampling time base converts the received signal to audio frequencies, and data are recorded in analogue form on magnetic tape. Computer-enhanced time sections for a glacier and an ice shelf are presented as examples. (49 refs.)

121385 Remote acoustic classification of marine sediments with application to offshore Newfoundland. N.A.Cochrane (Bedford Inst. of Oceanography, Dartmouth, NS, Canada), A.D.Dunsiger.
Can. J. Earth Sci. (Canada), vol.20, no.7, p.1195-211 (July 1983).
Shallow marine sediments can be remotely classified by the spatial correlation properties of their seismic reflection signatures provided one uses a highly repetitive broadband acoustic source. A classification scheme defined by three spatial coherence parameters is shown capable of automatically differentiating between several formations of unconsolidated sediments in a limited area of offshore Newfoundland. The consistency and generality of the technique are explored and comparisons with standard echogram interpretation are made. (16 refs.)

121386 Homomorphic deconvolution of potential field data in one and two dimensions. O.G.Jensen (Lab. in Appl. Geophys., McGill Univ., Montreal, Canada), P.P.Papazis.
Can. J. Earth Sci. (Canada), vol.20, no.8, p.1260-81 (Aug. 1983).
A signal in a non-dispersive reverberant environment can generally be represented as the sum of overlapping delayed replicas of a basic wave form. This convolutional data model has long been employed in seismic analysis and can be usefully extended for the analysis of gravity and magnetic potential field data. The deconvolution of gravity or magnetic data requires the separation of two basic components of the potential fields: one represents a basic irreducible wave form or signature of the potential field, and the other represents the position and scale or distribution of this wave form throughout the area of measurement. (25 refs.)

121387 FANTASIA—a program for target transformation factor analysis to apportion sources in environmental samples. P.K.Hopke, D.J.Alpert, B.A.Roscoe (Inst. for Environmental Studies, Univ. of Illinois, Urbana, IL, USA).
Comput. & Chem. (GB), vol.7, no.3, p.149-55 (1983).
A program for performing *Q*-mode factor analysis of data followed by target transformation factor analysis is described as well as a series of auxiliary programs that help to perform the analysis and to provide estimates of the uncertainties in the results. The operation of these programs is illustrated by an example applying them to a set of well-characterized geological data. (20 refs.)

121388 Improvements in cloud photogrammetry using airborne, side-looking, time-lapse cameras. C.J.Biter, T.W.Cannon, E.L.Crow, C.A.Knight, P.M.Roskowski (Nat. Center for Atmospheric Res., Boulder, CO, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.1047-55 (June 1983).
An airborne photographic system, in which the cameras are coupled with an inertial navigation system, was developed and used in a 1978 convective cloud study. Photogrammetric analysis from such a system is enhanced: cloud-feature positions can be determined without external references such as the Earth's horizon or cloud base in the photographs, and the data reduction process can be considerably automated. The authors describe the instrumentation, the photogrammetric theory, and the procedures for obtaining cloud measurements from the photographs. An empirical error analysis based on photographs of terrestrial targets is also presented. (17 refs.)

121389 A practical approach to flux measurements of long duration in the marine atmospheric surface layer. T.V.Blanc (Atmospheric Phys. Branch, Naval Res. Lab., Washington, DC, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.6, p.1093-10 (June 1983).
The practical limitations imposed by the marine environment on the principal flux-measurement methods for experiments requiring more than a few days' duration are examined. Reservations are presented as to the suitability of the bulk method as a primary determination for fluxes and stability. It is suggested that the profile (or gradient) method is more practical. The influence that marine platforms have upon various flux measurements is discussed. It is argued that marine flux measurements should always be accompanied by an auxiliary flux-determination method. The bulk method is recommended as an adjunct to the profile method, since the combination can yield two simultaneous determinations with only a modest increase in experimental effort. The appropriate vertical location of meteorological instrumentation is examined in conjunction with its realistically obtainable measurement accuracies. The practical aspects of employing buoys and marine towers are discussed. An extensive bibliography or marine field experiments, methods and instrumentation is presented. (171 refs.)

121390 Real-time measurement of precipitation using weather radar. D.H.Newsome, G.A.Clift.
Endeavour New Ser. (GB), vol.7, no.3, p.123-32 (1983).
The advent of weather radar making it possible to make almost instantaneous measurements of precipitation over a considerable area opens up very important new prospects for meteorological forecasting. Under the aegis of the European Community, the world's first international weather radar system is being planned, primarily to serve the needs of western Europe. It is expected, however, that techniques and equipment developed by European industry will be widely adopted elsewhere. (10 refs.)

121391 Multi-beam Doppler sonar observation of tidal flow turbulence. R.Lhermitte, H.Poor (Rosenstiel School of Marine & Atmospheric Sci., Univ. of Miami, Miami, FL, USA).
Geophys. Res. Lett. (USA), vol.10, no.8, p.717-20 (1983).
Preliminary results on tidal flow turbulence acquired from multi-beam Doppler sonar observations are presented. The Doppler sonar is a high resolution system capable of observing the spectrum of radial velocities in the scattering volume with a precision greatly exceeding the Doppler spectrum bandwidth. Such capability provides access to small scale water turbulence observations if foreign contributions to velocity variance are removed. This preliminary analysis of the data is primarily concerned with vertical and horizontal velocity turbulence as related to longitudinal mean flow velocity. (8 refs.)

121392 A fast data recording system for a rotating interferometer. E.C.Tan (Dept. of Electrical Engng., Univ. of Melbourne, Parkville, Victoria, Australia).
Int. J. Electron. (GB), vol.55, no.4, p.653-9 (Oct. 1983).
A fast data recording system has been designed for a special type of radio-wave direction-finder called a rotating interferometer. Its operation is verified and compared with that of the original pen and paper-chart recording system. Its application in ionospheric studies is discussed. (4 refs.)

121393 A method for the determination of absorption for refracted waves. Yu.P.Ampilov, T.I.Oblogina (Geology Faculty, Moscow State Univ., Moscow, USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.10 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.10, p.762-9 (1982). [received: Sept. 1983]
A method for determination of absorption characteristics of seismic waves is described. (9 refs.)

121394 The use of Magsat data to determine secular variation. J.C.Cain, J.Frayser, L.Muth, D.Schmitz (US Geological Survey, Denver, CO, USA).
J. Geophys. Res. (USA), vol.88, no.B7, p.5903-10 (10 July 1983).
A combined spatial and secular variation model of the geomagnetic field, labeled M061581, is derived from a section of Magsat data. The SV patterns from this new model are compared with those from the 1980 IGRF and with those for 1970 computed by the DGRF and with the 1960 patterns computed using the GSFC(12/66) model. Most of the features of the M061581 are identical in location and level with those of the 1980 IGRF. Together they confirm that the reversals in sign of field change seen over Asia and North America between 1965 and 1975 are reverting to the pre-1965 states. The M061581 model gives −32 nT/yr for the dipole decay rate, lager than the 70% increase already reported since 1975. This experiment indicates that secular variation can be obtained from satellite data for intervals of less than a full year if corrections can be made for seasonal effects and that 'annual snapshots' of the field by a satellite would allow easy and accurate models of secular change without the use of any surface data. (27 refs.)

121395 A new rock-magnetic approach to selecting sediments for geomagnetic paleointensity studies: application to paleointensity for the last 400 years. J.W.King, S.K.Banerjee, J.Marvin (Dept of Geology & Geophys., Univ. of Minnesota, Minneapolis, MN, USA).
J. Geophys. Res. (USA), vol.88, no.B7, p.5911-21 (10 July 1983).
The hypothesis that the ratio of detrital remanent magnetization to anhysteretic remanent magnetization (DRM/ARM) for sediment samples is a measure of relative geomagnetic paleointensity is critically evaluated by two distinct approaches. One approach is a detailed rock-magnetic examination of the implicit assumptions of the DRM/ARM method and the construction of the selection process by which to identify sediments that conform to requirements satisfying these assumptions. Sediments are 'uniform' with respect to DRM/ARM ratio if they contain magnetite in the 1-15 μm paticle size range as the predominant magnetic mineral and have variations in magnetite content of less than 20-30 times the minimum concentration. The DRM/ARM ratios of these sediments should provide estimates of relative geomagnetic paleointensity. A rock-magnetic evaluation of LeBoeuf Lake sediments with these techniques indicates that these sediments are suitable sediments are suitable for a relative paleointensity study. The second approach to evaluating the DRM/ARM ratio as a measure of relative paleointensity is direct comparison with absolute paleointensity data. A comparison between the LeBoeuf Lake estimates and Thellier-Thellier results from the western United States supports the conclusion that suitable sediments can record geomagnetic paleointensity fluctuations. (35 refs.)

121396 The correction for sediment loading on the seafloor. S.T.Crough (Dept. of Geosci., Purdue Univ., West Lafayette, IN, USA).
J. Geophys. Res. (USA), vol.88, no.B8, p.6449-54 (10 Aug. 1983).
Available measurements of sediment velocity and density indicate that a factor of 600 m s^{-1} of two-way sediment reflection time will correct seafloor depth to yield basement depth in the absence of sediment loading. This simple linear relation is derived from the results of six deep drill holes in abyssal sediments of the North and South Atlantic oceans. The relation predicts the sediment correction with an accuracy of about 50 m, regardless of the lithology sampled, down to a depth of 1.5 s of reflection time. The COST wells on the US continental shelf and empirical relations among velocity, density, porosity, and depth provide estimates of the deeper behaviour of abyssal sediments. (18 refs.)

121397 Stratospheric temperature profile from balloon-borne measurements of the 10.4-μm band of CO_2. C.P.Rinsland (Dept. of Phys., Coll. of William & Mary, Williamsburg, VA, USA), A.Goldman, F.J.Murcray, D.G.Murcray, M.A.H.Smith, R.K.Seals,Jr., J.C.Larsen, P.L.Rinsland.
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.4, p.327-34 (Oct. 1983).
The technique of nonlinear least squares spectral curve fitting has been used to derive the stratospheric vertical temperature profile from balloon-borne measurements of the 10.4-μm band of CO_2. The spectral data were obtained at sunset with the $\simeq$0.02 cm^{-1} resolution University of Denver interferometer system from a float altitude of 33.5 km near Alamogordo, New Mexico, on 23 March 1981. The r.m.s. deviation between the retrieved temperature profile and correlative radiosonde measurements is 2.2K. (39 refs.)

121398 Theory of radar detection of solitons during ionospheric heating. J.P.Sheering, D.R.Nicholson (Dept. of Phys. & Astron., Univ. of Iowa, Iowa City, IA, USA).
Phys. Lett. A (Netherlands), vol.97A, no.9, p.395-8 (26 Sept. 1983).
RF modifiers at some existing ionospheric heating facilities are found to be sufficiently intense for the production of (collapsing) solitons. Considering the detection of these solitons using Thomson radar, the authors treat the problem of an electromagnetic wave scattering off a collection of collapsing solitons. The cross section for the process is found to be relatively large and an intense plasma-line backscatter is predicted. An explanation of the phenomenon of 'plasma-line overshoot' is suggested. (9 refs.)

121399 Technology for large digital mosaics of Landsat data. A.L.Zobrist, N.A.Bryant, R.G.McLeod (Jet Propulsion Lab., Pasadena, CA, USA).
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.9, p.1325-35 (Sept. 1983).
Advances in algorithms and system executive procedures for digital image processing have made digital mosaics of Landsat images (both MSS and RBV) an attractive possibility. The technology developed includes simultaneous map projection and adjustment of frame edges to eliminate both geometric and radiometric seams. The incorporation of ground control points, either by manual or automatic ground control point file identification, has resulted in root-mean-square positional accuracies that exceed 1:100000 scale National Map Accuracy Standards. Rotation to north vertical is accomplished at low computational cost. Input data frames can be cut in any arbitrary shape to remove cloud cover and accommodate terrain offset effects. Two large applications in Pennsylvania and Bolivia are reported. A test case utilizing RBV data is described. (22 refs.)

121400 Detection of bottom features on Seasat synthetic aperture radar imagery. E.S.Kasischke, R.A.Shuchman, D.R.Lyzenga (Radar Div., Environmental Res. Inst. of Michigan, Ann Arbor, MI, USA), G.A.Meadows.
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.9, p.1341-53 (Sept. 1983).
A distinct set of surface patterns detected in imagery collected by the Seasat synthetic aperture radar (SAR) is shown to be the result of an interaction between a physical oceanic process and a bottom topographic feature. These patterns can be used to infer a bottom feature, and thus are a potential source of information for identifying submerged features hazardous to surface navigation. The Seasat SAR imaged bottom-related surface patterns in both deep and shallow water. Examples of these surface patterns are presented with explanations of how they occur. (46 refs.)

121401 Relative measurement of atmospheric pressure with a Digiquartz pressure transducer and a self-registering Fortin barometer (Agari-type). S.Sakakibara, T.Yamada, H.Satake, Z.Fujii, K.Murakami.
Proc. Cosmic-Ray Res. Lab. Nagoya Univ. (Japan), vol.26, no.1, p.13-26 (Feb. 1983). In Japanese.
Describes the Digiquartz pressure transducer and its temperature characteristics. A comparison is made with a Fortin barometer and hysteresis effects are examined. Results of tests over 100 days and field trials on Mt. Norikura at 2770 m over 55 days (1982 October 29-December 22) are presented. (no refs.) *M.J.C.*

121402 Passive microwave sensing of soil moisture content: the effects of soil bulk density and surface roughness. J.R.Wang (Lab. for Atmospheric Sci., NASA/Goddard Space Flight Center, Greenbelt, MD, USA).
Remote Sensing Environ. (USA), vol.13, no.4, p.329-44 (Sept. 1983).
Microwave radiometric measurements over bare fields of different surface roughness have been made at frequencies of 1.4 GHz, 5 GHz, and 10.7 GHz to study the frequency dependence, as well as the possible time variation, of surface roughness. An increase in surface roughness was found to increase the brightness temperature of soils. Radiometric time-series observations over a given field indicate that field surface roughness might gradually diminish with time, especially after a rainfall or irrigation. Three years of radiometric measurements over a test site revealed a possible inconsistency in the soil bulk density determination, which is an important factor in the interpretation of radiometric data. (25 refs.)

121403 Estimating surface temperatures from satellite thermal infrared data—a simple formulation for the atmospheric effect. J.C.Price (Hydrology Lab., Plant Physiology Inst., Beltsville, MD, USA).
Remote Sensing Environ. (USA), vol.13, no.4, p.353-61 (Sept. 1983).
Correction of the high spatial resolution satellite data for atmospheric water vapor effects can represent a substantial computational burden unless simplifying assumptions are utilized. A simple formulation is developed and its applicability tested by application to standard meteorological soundings at a time near the overpass of an NOAA operational satellite. It appears that reasonable estimates of surface temperature ($\pm$2-3 C°) are readily obtained for areas of order 100-300 km^2. (16 refs.)

121404 Analysis and design of a differential sunshine recorder. A.Ayensu (Dept. of Phys., Univ. of Cape Coast, Cape Coast, Ghana).
Sol. Energy (USA), vol.31, no.5, p.517-22 (1983).
Recently, Sayigh (Solar Energy Engineering, 1981) has given a compendium of the solar measuring instruments and has remarked on the importance of proper calibration. Since these instruments are not readily available in Ghana, it was decided to design and construct a simple differential sunshine recorder, that will record and measure direct solar radiation but would ignore 'sky' radiation (or diffuse radiation) scattered by the air molecules, water droplets in clouds, aerosols (dust, smoke, pollen) and gases present in the atmosphere (O_3, O_2, CO_2, H_2O). The theory, design and analysis of this instrument is presented. (4 refs.)

121405 Techniques for the precise estimation of hourly values of global, diffuse and direct solar radiation. A.Mani, S.Rangarajan (Indian Inst. of Tropical Meteorology, Bangalore, India).
Sol. Energy (USA), vol.31, no.6, p.577-95 (1983).
A method used to compute solar radiation, when no measured data are available, is the regression technique relating mean daily totals of global and diffuse solar radiation with the mean duration of sunshine. Using this method, regression parameters were obtained from the monthly mean values of daily totals of global solar radiation and sunshine at a network of 16 stations in India. Daily values of global and diffuse solar radiation were then computed for 121 stations using interpolated values of the regression parameters. Where no sunshine data was available, global and diffuse solar radiation were computed from cloud observations. By relating daily totals and the corresponding hourly values of global and diffuse solar radiation, two sets of curves were prepared valid for the whole country, using which mean hourly values of global and diffuse radiation could be deduced from the corresponding daily totals. The paper discusses the validity of the techniques for an extended network of 145 stations in India. Using a simple model, calculations of global and diffuse solar radiation on clear days were made for 145 stations from values of the solar constant and measured values of ozone, water vapour and atmospheric turbidity. A method of extending the technique to overcast skies and partly clouded skies is discussed. (15 refs.)

121406 The solution of seismic interpretation problems using the finite element method. V.N.Trojan.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.3, p.21-6 (Aug. 1983). In Russian.
Algorithms are suggested for solving the following seismic interpretation problems: determination of the seismic shape, estimation of the impulse response of the media and approximation of the seismic horizon. The iterative algorithm has been developed for determining seismic signal parameters. B-spline functions are used as basic functions in the finite element method. (3 refs.)

121407 Wireline logging and coal measures rock strength. P.A.S.Elkington.
Univ. Nottingham, England thesis, 1981
Instrumentation for the wireline logging of surface boreholes is described with special reference to the compact slimline systems designed for operation in small diameter coalfield holes. The use of logs as lithology indicators is outlined and some of the problems of interpretation in coal measures strata are highlighted. It is suggested that greater use could be made of wireline logs during the design phase of coal mining projects. In particular, their ability to predict intact rock strength is examined and the potential geotechnical applications are considered. Extensive use has been made of the point load strength test on rock core from deep boreholes drilled in Nottinghamshire and Staffordshire; testing at small regular intervals has enabled continuous strength curves to be generated and compared directly with down hole responses. Those logs best able to predict the rock strength are identified and the relationships are quantified using a log blocking procedure. A multivariate analysis technique is used to combine the log responses into a single strength prediction equation. Strength calibration is discussed and other log-derived properties are compared with laboratory measurements. Some conventional log interpretation methods are shown to be inadequate in coal measures strata.

121408 Classification of Landsat data by means of color-transformations. K.Conradsen, G.Nilsson (Inst. of Math. Statistics & Operations Res., Tech. Univ. of Denmark, Lyngby, Denmark).
Proceedings of the 3rd Scandinavian Conference on Image Analysis, Copenhagen, Denmark, 12-14 July 1983 (Lund, Sweden: Studentlitteratur 1983), p.164-72
Some methods are suggested for improving the numerical classifications of geological units by means of remotely sensed multispectral scanner (MSS) data from e.g. Landsat satellites. The methods are based on transforming the ratios between different MSS bands to a cylindrical coordinate system that approximates the Munsell colour coordinates hue, saturation and value. Some distributional results are presented and the method is tested on Landsat data from Greenland. (6 refs.)

121409 Two-dimensional filtering with one-dimensional approach: the scanner regression-filter (SRF). M.Ehlers (Inst. fur Photogrammetrie und Ingenieurvermessungen, Univ. Hannover, Hannover, Germany).
Proceedings of the 3rd Scandinavian Conference on Image Analysis, Copenhagen, Denmark, 12-14 July 1983 (Lund, Sweden: Studentlitteratur 1983), p.173-81
Scanner imagery recorded over homogeneous areas often shows typical scan-line-structures. This is especially true for high amplified thermal infrared data of water surfaces. The scan-line-noise is a great disadvantage for quantitative evaluation. So the noise has to be removed by previous digital filtering. For this purpose a special spatial domain filter, the scanner-regression filter (SRF) for scanner imagery is developed. With the assumption that scan-line-noise is column independent the two-dimensional problem can be solved with a one-dimensional approach. The SRF method is compared to common techniques in the spatial and frequency domain and shows best results. (8 refs.)

121410 The instrument for the determination of dissolved oxygen in seawater. Zhang Rongkun, Luo Yinghua, Weng Xinqiao, Deng Gumin (Xiamen Univ., China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.73-82
The instrument described is a new type of oxygen analyzer, based on an electroanalytical method—laminar flow chronocoulometry. It can determine the content of oxygen in seawater as well as environmental waters with high accuracy. The instrument features an automatic control sequence and high-speed operation. The oxygen content is displayed with $2^1/_2$ digit resolution. The water sample flows to the sealed electrode cavity automatically, isolated from air so that the results of determination are accurate and reliable. (7 refs.)

121411 Application of the atomic Voigt effect for the determination of the trace elements (Ag, Pb, Rb). Li Jia Xi, Deng Yi Chen, Yang Xiao Tao (Acad. of Geological Sci., China).
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.93-100
Atomic absorption spectrometry (AAS) and atomic fluorescence spectrometry (AFS) are widely used in routine analysis of the geological and environmental samples. However, the sensitivity and the efficiency of these methods is still not satisfactory. The technique of forward scattering or magnetic optic rotation (MOR) is an effective advanced method for improving both the limitations. The authors describe the characteristics of MOR, compare it with AAS and AFS for trace analysis, discuss the factors that govern the output signal and the linearity, and establish the working parameters for determining Ag, Pb, and Rb, which have detection limits of 3.4×10^{-13}g, 5.8×10^{-12}g, 5.4×10^{-13}g respectively. (8 refs.)

121412 Digital filtering of the data of sea-level survey [for earthquake prediction]. Hu Guan-rui (Shanghai Jiao Tong Univ., Shanghai, China), Duan Hua-chen.
MICONEX '83 Proceedings of a Multinational Instrumentation Conference, Shanghai, China, 12-16 April 1983 (Research Triangle Park, NC, USA: ISA 1983), p.289-95
Digital filtering methods for sea-level data analysis and the results acquired are discussed. By using monthly mean data and eliminating regular annual variation, the influence of the periodic factors on sea-level data has been removed. This method is universally applicable and is expected to provide information on premonitary symptoms of macroseism. (5 refs.)

121413 Scintillation modelling and measurement: a tool for remote-sensing slant paths. E.Vilar, J.Haddon (Dept. of Electrical & Electronic Engng., Portsmouth Polytech., Portsmouth, England).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.27/1-13
The use of spectral analysis of amplitude scintillations as a remote-sensing tool of a slanted path is investigated in order to derive values of C_n^2 (refractive index structure constant), turbulent path L, and dominant eddy size. Relevant propagation aspects are reviewed and extended, a layer model analysed in detail, and experimental results are presented and discussed. The limitations of the remote-sensing technique are also discussed, particularly the use of cross-path wind v_t. The remote-sensing of v_t is briefly outlined and relevant antenna aperture effects are also considered. (30 refs.)

Advanced Remote Sensing .... See Entry 116914

Effective utilization of analytical instrument on measurement system—transitional measurement of amplitude probability density distribution for random fluctuation by pulse height analyzer and its application ....See Entry 117146

New generation lens systems for the Wild aviophot aerial camera system ....See Entry 118249

Complex I and II model performance evaluation in Nevada and New Mexico .. ..See Entry 120790

A dynamical estimation method of environmental noise system based on the quantized level measurement contaminated by the background noise ....See Entry 120797

Map projection transformation with digitally controlled differential rectifiers ... .See Entry 121089

Modelling of vertical crustal movements by means of collocation ....See Entry 121090

Unbiased estimation of variance-covariance components in condition adjustment with unknowns—a MINQUE approach ....See Entry 121091

The influence of non-orthogonal eccentric theodolite axes on the circle readings .... See Entry 121092

Inversion of geophysical electromagnetic measurements, limitations and approximate solutions .... See Entry 121093

Annual report for magnetic observatories—1981 .... See Entry 121097

Effect of deep fractures on the resolution capacity of magnetotelluric sounding .... See Entry 121099

On the Green's functions for a layered half-space. I .... See Entry 121106

On the Green's functions for a layered half-space. II .... See Entry 121107

Microfilming of historical seismograms from the Mount Hamilton (Lick) Seismographic Station .... See Entry 121118

Crosshole seismology and seismic imaging in crystalline rocks .... See Entry 121121

On the methods of spectral characterisation of nonstationary random processes with application to the study of earth tremors. III .... See Entry 121153

Method and results of determining the absorption of seismic waves in the central part of the Baikal Rift Zone .... See Entry 121154

Interpretation of data of multiple systems of observations of refracted waves when studying the basement of the West Siberian Platform .. See Entry 121155

The dendrochronological dating of seismogenic ruptures in the Stanovoi highland .... See Entry 121156

Rb-Sr and U-Pb dating of bentonites .... See Entry 121163

Evaluation of the parameters of a medium in constructing a block model by seismic methods .... See Entry 121165

Scanning electron microscopic examination of pyroclastic materials: basic considerations .... See Entry 121184

Photoacoustic spectra of natural apatites in the near ultraviolet and visible regions .... See Entry 121214

Forced vibrations and integral equations of a fluid resonator. Applications to the study of fissures in the middle of rocks .... See Entry 121235

The sampling variability of estimates of spectra of wind-generated gravity waves .... See Entry 121260

SEASAT synthetic aperture radar observations of wave-current and wave-topographic interactions .... See Entry 121261

Imaging radar observations of directional properties of ocean waves .... See Entry 121262

Comparison of the TIROS-N satellite and aircraft measurements of Gulf Stream surface temperatures .... See Entry 121275

^{10}Be and Be in the Maurice River-Union Lake system of southern New Jersey .... See Entry 121296

An improved technique for estimating mean depth of lakes ... See Entry 121303

Heavy thunderstorms observed over land by the Nimbus 7 scanning multichannel microwave radiometer .... See Entry 121326

On the evaluation of wind power from short wind records ..... See Entry 121329

Large amplitude middle atmospheric electric fields: fact or fiction? .... See Entry 121335

Scattering by Pruppacher-Pitter raindrops at 30GHz .... See Entry 121345

Remote sensing of atmospheric waves in O_2 and H_2O microwave emissions .... See Entry 121346

Spectral parameter estimation of CAT radar echoes in the presence of fading clutter .... See Entry 121348

Comparison of spherical double probe electric field measurements with plasma bulk flows in plasmas having densities less than 1 cm^{-3} .... See Entry 121461

Occurrence properties of ducted whistler-mode signals from the new VLF transmitter at Siple Station, Antarctica .... See Entry 121478

Pulse-to-pulse correlation in satellite radar altimeters .... See Entry 121505

Cosmic ray data transmission using the if-800 personal computer system .... See Entry 121541

94.00 AERONOMY AND SPACE PHYSICS

94.10 PHYSICS OF THE NEUTRAL ATMOSPHERE

(for planets, see 96.30)

121414 Atmospheric sodium chemistry and diurnal variations: an up-date. V.W.J.H.Kirchhoff (Inst. de Pesquisas Espaciais, Conselho Nacional de Desenvolvimento Cientifico e Technologico-CNPq, Sao Paulo, Brazil).
Geophys. Res. Lett. (USA), vol.10, no.8, p.721-4 (1983).
Recent results for sodium reaction rates have led to a reassessment of the importance of atmospheric sodium constituents and their distribution with height. The largest changes occur at the bottom of the neutral atmospheric sodium layer. A much larger reaction rate coefficient for the three body production of NaO_2 makes this constituent potentially much more dense below about 80 km, whereas the inclusion of photolysis produces a large dirunal variation in the NaOH loss frequency. Because many of the Na reaction rates are still uncertain static calculations for four different options on reaction rates have recently been offered in the literature. The present author shows that only one of these choices is able to produce diurnal variations that are in agreement with recent measurements. (27 refs.)

121415 Lower thermospheric structure from Millstone Hill incoherent scatter radar measurements. I. Daily mean temperature. R.H.Wand (MIT, Haystack Obs., Cambridge, MA, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.7201-9 (1 Sept. 1983).
Daytime temperature determinations from 151 days of incoherent scatter radar measurements at Millstone Hill (42.6°N) from 1970 to 1975 were analyzed to characterize the mean daily temperature in the lower thermosphere (105-125 km). An analytical model fitted to the measured temperatures contained terms to specify the dependencies of the mean daily temperature on day of year (annual and semiannual terms), solar cycle, solar rotation, and geomagnetic activity. The model representation, whose coefficients are tabulated, showed that seasonal, solar cycle, and geomagnetic effects were all of comparable magnitude and could each produce a variation of 5-10% in the mean temperature. The solar rotation effects were found to be small. (24 refs.)

121416 Lower thermospheric structure from Millstone Hill incoherent scatter radar measurements. II. Semidiurnal temperature component. R.H.Wand (MIT, Haystack Obs., Cambridge, MA, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.7211-24 (1 Sept. 1983).
For pt.I see ibid., vol.38, no.A9, p.7211-24 (1983). Daytime temperature determinations from 151 days of incoherent scatter radar measurements at Millstone Hill (42°N) from 1970 to 1975 were analyzed to characterize the semidiurnal temperature oscillation in the lower thermosphere (105-125 km). An analytical model fitted to the measured temperatures contained terms to specify the dependencies of the semidiurnal term on day of year (annual and semiannual terms), solar activity, and geomagnetic activity. The model representation, whose coefficients are tabulated, showed that seasonal effects were larger than effects associated with the other parameters. The annual mean semidiurnal oscillation (for $Kp=0$, $\bar{F}_{10.7}=120$) had a maximum amplitude of 28K at 115 km and a vertical wavelength of 43 km. Variations associated with season were large. (28 refs.)

121417 Latitudinal (seasonal) variations in the thermospheric midnight temperature maximum: a tidal analysis. F.A.Herrero, H.G.Mayr, N.W.Spencer (Lab. for Planetary Atmospheres, NASA Goddard Space Flight Center, Greenbelt, MD, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.7225-35 (1 Sept. 1983).
Recent observations of a seasonal oscillation in the time of occurrence of the thermospheric midnight temperature maximum suggest that even at low latitudes ($<20°$) there is a latitudinal (seasonal) variation in the amplitudes and phases of the higher-order tidal modes. Temperature data from the Atmosphere Explorer E Neutral Atmosphere Temperature Experiment have been used to investigate this question, obtaining the temperature as a function of local time at two mean latitudes: $-17.5°$ and $17.5°$. The altitude range covered is 250-400 km. the 24-hour temperature functions are obtained during the same time of the year in both hemispheres, and they show the midnight temperature maximum occurring earlier in the summer hemisphere than in the winter hemisphere. Tidal analysis of the temperature function shows that the observed variations can be accounted for by the first three tidal harmonics. (17 refs.)

121418 A point of view on semi-empirical thermospheric models. F.Barlier, C.Berger (CERGA/GRGS, Grasse, France).
Planet. & Space Sci. (GB), vol.31, no.9, p.945-66 (1983). (European Geophysical Society Meeting on the Structure of the Upper and Middle Atmosphere, Leeds, England, 23-27 Aug. 1982).
Different types of models of the thermosphere, either with experimental characteristics or with theoretical characteristics, have been elaborated since the Space Age. These models describe the variation of different parameters (temperature, density, pressure, concentrations etc.). A brief description of these models is given. As far as theoretical models are concerned, the conservation equations of energy, of momentum or mass and physico-chemical processes are taken into account. Experimental models are based upon empirical representation of variations of parameters at a reference altitude, assuming diffuse equilibrium for each component. (90 refs.)

121419 Determination of atmospheric composition and temperature from the UV airglow. R.R.Meier, D.E.Anderson,Jr. (E.O. Hulburt Center for Space Res., Space Sci. Div., Naval Res. Lab., Washington, DC, USA).
Planet. & Space Sci. (GB), vol.31, no.9, p.967-76 (1983). (European Geophysical Society Meeting on the Structure of the Upper and Middle Atmosphere, Leeds, England, 23-27 Aug. 1982).
Recent spectroscopic observations of atmospheric emissions in the UV region of the spectrum have been analyzed using laboratory-measured excitation cross-sections, models and observations of energetic electron fluxes and models of atmospheric composition. In both the airglow and the aurora, self-consistent pictures of the excitation processes and atmospheric composition have been obtained. It is shown that accurate quantitative determinations of thermospheric parameters can now be made from UV spectral observations, and that the composition and temperature can be obtained from altitude profiles of the emissions alone, without reliance on the absolute photoelectron flux. (29 refs.)

121420 Solar indices and solar UV-irradiances. L.Bossy (Inst. Royal Meteorologique, Brussels, Belgium).
Planet. & Space Sci. (GB), vol.31, no.9, p.977-85 (1983). (European Geophysical Society Meeting on the Structure of the Upper and Middle Atmosphere, Leeds, England, 23-27 Aug. 1982).
Daily values of the solar radio fluxes, Zurich relative sunspot number R_z, and solar Ca II plage indexes for the period 1957-1980 are analyzed in order to test the stability of the series with respect to time and solar activity. Then, the daily solar UV-irradiances measured since 1969 for H Lyman-alpha and beta, the He I resonance line and He II Lyman alpha are compared with the 10.7 cm radio fluxes and adjusted. This adjustment allows the determination of the slope of the mean variation of the UV-irradiances with solar activity. The increases from solar minimum to solar maximum related to the minimum values are respectively: 60% for H Lyman alpha, 80% for H Lyman beta and 90% for He I and He II. (12 refs.)

121421 Photodissociation effects of solar UV radiation. P.C.Simon, G.Brasseur (Inst. d'Aeronomie Spatiale de Belgique, Bruxelles, Belgium).
Planet. & Space Sci. (GB), vol.31, no.9, p.987-99 (1983). (European Geophysical Society Meeting on the Structure of the Upper and Middle Atmosphere, Leeds, England, 23-27 Aug. 1982).
Reviews the current knowledge of UV solar irradiances beyond 120 nm measured during solar cycle 21. Parameters required to calculate the atmospheric attenuation of the UV radiation and the photodissociation rate of neutral constituents are discussed. The effect of scattering is also considered. (85 refs.)

121422 Excitation of acoustic gravity waves by sources moving in the atmosphere at an angle with the horizon. G.I.Grigor'ev, O.N.Savina (Sci.-Res. Inst. of Radiophys., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.532-41 (July 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.750-60 (July 1982). [received: Sept. 1983]
The Cerenkov radiation of acoustic gravity waves by sources moving with a constant velocity in the atmosphere at an angle with the horizon is investigated. Relations for the amplitude and radiated power of these waves are derived and analyzed in several limiting cases. The constant-phase surfaces of the generated disturbances are determined. (14 refs.)

European Geophysical Society Meeting on the Structure of the Upper and Middle Atmosphere .... See Entry 116924

Electron impact excitation of λ7990-Å multiplet .... See Entry 117996

Simultaneous observations of tropicl arc SAR arc and aurora during geomagnetic storms from IC-Bulgaria-1300 satellite .... See Entry 121423

Sunrise effect on long wave propagation along the Tashkent-Patiala path .... See Entry 121430

Photochemistry of N_2^+ in the daytime F region .... See Entry 121443

Satellite orbital precession caused by a rotating oblate atmosphere with a diurnal variation in density .... See Entry 121503

The advance of the perigee of a satellite in a rotating oblate atmosphere with a diurnal variation in density .... See Entry 121504

27-day variations observed in solar UV (120-300 nm) irradiance .... See Entry 121649

94.10Q Airglow and nightglow

Electron impact excitation of λ7990-Å multiplet .... See Entry 117996

Determination of atmospheric composition and temperature from the UV airglow .... See Entry 121419

94.10S Aurora

121423 Simultaneous observations of tropicl arc SAR arc and aurora during geomagnetic storms from IC-Bulgaria-1300 satellite. M.M.Gogoshev (Central Lab. for Space Res., Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.6, p.779-82 (1983).
The features: SAR arcs, tropical arcs and auroras are discussed particularly in the context of electric and magnetic fields, electron and proton fluxes, ion composition, plasma drift and spectra. (10 refs.)

121424 A statistical study of the dynamics of the equatorward boundary of the diffuse aurora in the pre-midnight sector. J.A.Sauvaud, J.Crasnier (CNRS-Univ. Paul Sabatier, Toulouse, France), Yu.I.Galperin, Y.I.Feldstein.
Geophys. Res. Lett. (USA), vol.10, no.8, p.749-52 (1983).
Presents a statistical study of the dynamics of the equatorward boundary of the diffuse aurora. This soft electron boundary appears to be best fitted by using the AE index values averaged over the 5 hours preceding the measurements. This inertia of the boundary is interpreted as indicative (1) of the action of a polarization electric field braking the inward motion of the corresponding equatorial plasma during increasing magnetic activity so that several successive perturbations are needed to obtain a consequent inward displacement and (2) of a weak wave-particle interaction during periods of decreasing magnetic activity. (20 refs.)

121425 A quantitative description of the spatial distribution and dynamics of the energy flux in the continuous aurora. J.A.Whalen (Air Force Geophys. Lab., Hanscom AFB, MA, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.7155-69 (1 Sept. 1983).
Energy flux in the continuous (or diffuse) aurora is found to be constant instantaneously along contours that are defined analytically as a function of magnetic latitude and UT, coordinates that are approximately circles in magnetic latitude-magnetic local time centered at a pole offset from the magnetic pole. As a consequence, the latitudinal distribution in these coordinates is the same instantaneously at all magnetic local times (the observed extent of which is 10 hours); changes that take place in the distribution do so simultaneously (within 15 min of UT resolution) throughout this entire extent. These properties are observed in a case study of 8 hours duration by an array of ground and air based ionospheric sounders that span the 10 hours of magnetic local time at auroral latitudes. Energy flux in the continuous aurora is derived from the resulting ionized auroral E layer critical frequency that is measured simultaneously at 15 min intervals by all members of the array. (32 refs.)

121426 Analytical yield spectrum approach to electron energy degradation in Earth's atmosphere. S.A.Haider, R.P.Singhal (Appl. Phys. Section, Inst. of Technol., Banaras Hindu Univ., Varanasi, India).
J. Geophys. Res. (USA), vol.88, no.A9, p.7185-9 (1 Sept. 1983).
Analytical spatial yield spectrum approach has been applied to calculate the electron flux, volume excitation, and ionization rates for monoenergetic electrons incident on the Earth's atmosphere. The results have been compared with the previous model calculations of Mantas and Walker (1976) and Banks et al. (1974). (17 refs.)

Electron impact excitation of λ7990-Å multiplet .... See Entry 117996

Determination of atmospheric composition and temperature from the UV airglow .... See Entry 121419

A theoretical approach to the morphology and the dynamics of diffuse auroral zones .... See Entry 121442

VHF-long-distance-propagation by auroral backscatter .... See Entry 121450

94.20 PHYSICS OF THE IONOSPHERE

(for planets, see 96.30)

121427 Probing the ionosphere an aid to research. A.Farmer (Rutherford Appleton Lab., Chilton, England), R.Norton.
Commun. Aust. (Australia), vol.2, no.3, p.24-5, 27 (Aug. 1983).
Discusses the European Incoherent Scatter Scientific Association (EISCAT) research programme. It uses two radar systems, a 6 MW VHF transmitter-receiver and a UHF system with three ground stations for investigating radio propagation. The UHF system consists of a 933.3 MHz transmitter-receiver located in Norway. (no refs.)

121428 Equatorial ionospheric currents derived from MAGSAT data. M.Roy (Indian Inst. of Geomagnetism, Colaba, Bombay, India).
Geophys. Res. Lett. (USA), vol.10, no.8, p.741-4 (1983).
The MAGSAT data on the three components of the geomagnetic field are subjected to ring current correction and crustal anomaly elimination near the dip equator. The evidence of a strong west east electrojet current below the satellite height ($\sim$ 350 km) is confirmed. Strong evidence of an east west component of the field suggests the existence of a vertical current originating at the jet level and extending upwards. A model calculation shows that such a current system can explain the satellite data as well as the ground data. (7 refs.)

121429 Upward electron beams measured by DE-1: a primary source of dayside region-1 Birkeland currents. J.L.Burch (Dept. of Space Sci., Southwest Res. Inst., San Antonio, TX, USA), P.H.Reiff, M.Sugiura.
Geophys. Res. Lett. (USA), vol.10, no.8, p.753-6 (1983).
Measurements made by the High Altitude Plasma Instrument on DE-1 have shown that intense upward electron beams with energies from $\approx$20 eV to $\approx$200 eV are a common feature of the region just equatorward of the morning-side polar cusp. Computations of the currents carried by these beams and by the precipitating cusp electrons show excellent agreement with the simultaneous DE-1 magnetometer measurements for both upward and downward Birkeland currents. The data indicate that cold ionospheric electrons, which carry the downward region-1 Birkeland currents on the morning side, are accelerated upward by potential drops of a few tens of eV at altitudes of several thousand kilometers. This acceleration process allows spacecraft above those altitudes to measure routinely the charge carriers of both downward and upward current systems. (19 refs.)

121430 Sunrise effect on long wave propagation along the Tashkent-Patiala path. A.Sayal, D.Singh, H.S.Gurm (Dept. of Astron. & Space Sci., Punjabi Univ., Patiala, India).
Indian J. Radio & Space Phys., vol.12, no.3, p.74-6 (June 1983).
Data from the 164 kHz long wave propagtion observations at Patiala are analysed to find the factors responsible for the observed sunrise effect. Monthly variation of solar zenith angle at the sunrise time is similar to the monthly variation of the total ozone content which points to the presence of an ozone screening layer at pre-sunrise time. The results also indicate that at the midpoint of Tashkent-Patiala path cosmic Kray ionization plays an important role during sunrise. The start of the sunrise effect is a result of UV light grazing the ozone screening layer and the release of electrons at $\chi=98°$ is due to the photodetachment of NO_3^-. (10 refs.)

121431 Low latitude integrated production and loss rates from Faraday rotation experiment using ATS-6 and ETS-II satellite transmissions. R.S.Dabas, P.K.Bhuyan, T.R.Tyagi, L.Singh, Y.V.Somayajulu (Radio Sci. Div., Nat. Phys. Lab., New Delhi, India).
Indian J. Radio & Space Phys., vol.12, no.3, p.81-3 (June 1983).
Faraday fading records obtained near sunrise at Gauhati and Delhi using ATS-6 transmissions (1975-76) and at Delhi using ETS-II transmissions (1979-80) are analyzed to obtain the integrated production rate for the overhead Sun (Q_0) and the effective loss rate (β). The results of Q_0 and β are quite dissimilar for the two stations. An attempt is made to explain qualitatively the observed variations with the neutral composition changes of the (N_2/O) ratio. (21 refs.)

121432 Ionospheric electron content measurements at a northern low mid-latitude station through half a solar cycle. P.K.Bhuyan, T.R.Tyagi, L.Singh, Y.V.Somayajulu (Radio Sci. Div., Nat. Phys. Lab., New Delhi, India).
Indian J. Radio & Space Phys., vol.12, no.3, p.84-93 (June 1983).
Ionospheric electron content (IEC) measurements with the help of geostationary satellite radio beacon have been made at Delhi during the period 1975-80. Results for three 1-yr periods representing low, medium and high solar activity conditions are presented. Detailed study of the diurnal, seasonal and solar cycle variations reveals a number of new features which were not observed earlier from observations made with low orbiting satellites. Study of the behaviour of IEC during different hours of the day with season and solar activity reveals that IEC behaves differently in daytime and nighttime. Also, the harmonic components beyond the third one do not show any significant values. (56 refs.)

121433 F-region vertical velocity and its fluctuations at the magnetic equator. K.S.V.Subbarao, B.V.Murthy (Space Phys. Div., Vikram Sarabhai Space Centre, Trivandrum, India).
Indian J. Radio & Space Phys., vol.12, no.3, p.94-6 (June 1983).
F-region vertical velocities in the evening time are estimated at two levels from simultaneous phase-path observations on two frequencies, 2.2 and 4.1 MHz. It is found that electrodynamic drift is greater at lower level than that at higher level. Wave-type disturbances with a period of 9 min are observed. (5 refs.)

121434 D-region model study for Udaipur. T.C.Bansal, S.K.Vijayvergia, R.K.Rai (Dept. of Phys., Univ. of Udaipur, Udaipur, India).
Indian J. Radio & Space Phys., vol.12, no.3, p.97-9 (June 1983).
On the basis of a simplified ion-chemical scheme a D-region model is prepared. Multifrequency absorption results measured at Udaipur match with the electron density profile obtained from the scheme. The results are compared with positive ion and electron concentrations measured at the same solar zenith angle position over Thumba. The scheme used is slightly different from that of the existing ones in both negative and positive ion sides. (26 refs.)

121435 Energetic electron precipitation due to gyroresonant interactions in the magnetosphere involving coherent VLF waves with slowly varying frequency. H.C.Chang, U.S.Inan, T.F.Bell (Space, Telecommunications & Radiosci. Lab., Stanford Univ., Stanford, CA, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.7037-50 (1 Sept. 1983).
A test particle simulation model (Inan et al., 1982) of the gyroresonance wave-particle interaction in the magnetosphere is extended to study the transient particle precipitation fluxes induced by various coherent VLF waves with slowly varying frequency propagating along the Earth's magnetic field lines. For moderate wave intensities ($B_\omega \leq 10$ pT at $L=4$) a comparison between input signals with linearly rising and falling frequencies shows that they induce the same amount of precipitated particle energy deposition. However, when the wave growth near the principal interaction region is considered, the precipitation induced by a riser is considerably higher than that induced by a faller. (33 refs.)

121436 Standing wave patterns in VLF Hiss. R.Brittain, P.M.Kinter, M.C.Kelley (School of Electrical Engng., Cornell Univ., Ithaca, NY, USA), J.C.Siren, D.L.Carpenter.
J. Geophys. Res. (USA), vol.88, no.A9, p.7059-64 (1 Sept. 1983).
Observations have been made of systematic patterns in VLF hiss, which can be interpreted as a standing wave pattern formed by reflection in the lower ionosphere. Multicomponent VLF electric and magnetic field experiments were flown on three sounding rockets (Nike-Tomahawk 18.203-305) from Siple Station. Antarctica during December 1980 to January 1981. One feature of the natural emissions was observed in a very similar form during each flight. A band of hiss, typically from 1.5 to 3 kHz, was seen on the upleg to form a series of closely spaced stripes with whistler-like dispersion. These first appeared at an altitude of 90-95 km and extended for as much as 40 km in alitutde. On the downleg the stripes were observed at the same altitude with the pattern reversed in time. No such patterns were observed by the VLF receivers operating at the same time on the ground at Siple or at its conjugate point. It is suggested that the patterns are interference effects due to downcoming waves reflecting from a layer in the *E* region and forming a standing wave pattern. (15 refs.)

121437 In situ measurements of transionospheric VLF wave injection. P.M.Kintner, R.Brittain, M.C.Kelley (School of Electrical Engng., Cornell Univ., Ithaca, NY, USA), D.L.Carpenter, M.J.Rycroft.
J. Geophys. Res. (USA), vol.88, no.A9, p.7065-73 (1 Sept. 1983).
VLF waves at 3.85 kHz from the Siple, Antarctica, transmitter were continuously measured by electric and magnetic receivers on a sounding rocket as the waves propagated through the neutral atmosphere and into the ionosphere. The change from linear to circular polarization was clearly observed along with severe attenuation of the VLF signal in the *D* region. Interferometric measurements established the index of refraction and provided an independent calibration of the rocket-borne receivers. An upper bound on the VLF power radiated is estimated to be 1.7×10^3 W during a period when the antenna was

driven at 115×10^3 W. The power estimated to be entering the ionosphere is between 3 W and 12 W. (24 refs.)

121438 Observations and modeling of multi-frequency VHF and GHz scintillations in the equatorial region. S.J.Franke, C.H.Liu (Ionosphere Radio Lab., Univ. of Illinois, Urbana, IL, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.7075-85 (1 Sept. 1983).
Amplitude scintillation spectra and statistics obtained simultaneously at VHF (257.55 MHz), L band (1541.5 MHz), and C band (3945.5 MHz) from the MARISAT communications satellite (15°W) are presented. The measurements were made at Ascension Island (7°58′S, 14°25′W, 30°S DIP) over a high elevation propagation path within a few degrees of the magnetic meridian plane. The multi-frequency data and the unique propagation geometry enable study of the structures of the equatorial ionospheric irregularities closely. Numerical simulation is used to model a specific event. Comparisons between the modeling results and the observations indicate that the data are consistent with the recently measured (in situ) two-component power law irregularity spectrum with a shallow largescale regime and a steeper smallscale regime, and a spectral break at about 1-km scale size. (22 refs.)

121439 Ion-Pedersen drift and parallel electric field effects on plasma jetting. J.L.Sperling (Jaycor, San Diego, CA, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.7095-106 (1 Sept. 1983).
The combination of ion-Pedersen currents and parallel electric fields are shown to affect significantly both the jetting of ionospheric plasma clouds transverse to the geomagnetic field and the Alfven waves generated by the moving plasma. Ion-Pedersen currents and parallel electric fields invalidate the 'frozen-in' field approximation and cause Alfven waves to decay. They also imply an eigenvalue condition on the size of the plasma cloud transverse to the geomagnetic field and the direction of cloud motion. The attenuation of Alfven waves reduces the likelihood that the waves can cause an electromagnetic pulse on the ground and implies that the initial directed energy in the plasma jet is coupled, over great distances, to ions and electrons. (18 refs.)

121440 Altitude and structure of an auroral arc acceleration region. G.Paschmann, J.Papamastorakis, N.Sckopke, G.Haerendel (Max-Planck-Inst. fur Phys. und Astrophys., Inst. fur Extraterrestriche Phys., Garching, Germany), E.G.Shelley.
J. Geophys. Res. (USA), vol.88, no.A9, p.7121-30 (1 Sept. 1983).
During a rocket flight in the dayside auroral oval on December 17, 1974, several examples of velocity dispersions of precipitating electrons were observed. It is shown that the commonly employed interpretation of such dispersions as resulting from a purely temporal modulation of the source is not unique: the same dispersion effects can also be caused by a moving source of finite width and constant intensity. This spatial model is further improved by adding the dispersion originating from a superimposed convection velocity. In general the source altitudes implied by the two models (temporal and spatial) differ. (30 refs.)

121441 Spatial relationship of field-aligned currents, electron precipitation, and plasma convection in the auroral oval. W.R.Coley (Center for Space Sci., Univ. of Texas, Dallas, TX, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.7131-41 (1 Sept. 1983).
The utilization of magnetometer measurements to determine field-aligned current structure in conjunction with energetic particle and plasma convection measurements from AE-C enables the author to determine relationships between these phenomena in the nighttime auroral zone. From a study of some 18 auroral oval crossings in the sectors 1800-2200 MLT and 0100-0600 MLT it is observed that, in general, the regions of energetic electron precipitation (>1 keV) span both region 1 and region 2 currents with the poleward boundary of the region 1 currents approximately coincident with the poleward kilovolt electron boundary. Simultaneous observations of plasma convection indicate that the reversal from sunward to antisunward convection is also, in general, collocated to within a degree of invariant latitude to the poleward field-aligned current boundary in both the evening and morning sectors. (34 refs.)

121442 A theoretical approach to the morphology and the dynamics of diffuse auroral zones. D.Fontaine, M.Blanc (CNET, Issy-les-Moulineaux, France).
J. Geophys. Res. (USA), vol.88, no.A9, p.7171-84 (1 Sept. 1983).
The authors focus upon a quantitative description of the effects of large-scale convection on diffuse precipitation. The transport of 100 eV-10 keV electrons from the geomagnetic tail earthward by the convection electric field, and their pitch angle diffusion into the loss cone by wave-particle interactions are believed to be the main cause of diffuse auroral electron precipitation. For the main purpose of diffuse precipitation modeling, the authors propose a simplified approach to this problem and test its validity against direct observations of the location and dynamics of diffuse auroral emissions. Using basically the strong pitch angle of diffusion limit a set of fluid equations describing the three-dimensional transport of plasma sheet electrons is derived. Their integration provides the latitude and local time distribution of precipitation fluxes and characteristic energies at the top of the ionosphere as a function of the large-scale dawn to dusk electrostatic potential drop. The calculated expansion of the auroral oval with magnetic activity, deduced from this model, approaches the experimental results. (39 refs.)

121443 Photochemistry of N_2^+ in the daytime F region. E.L.Breig, W.B.Hanson, J.H.Hoffman (Center for Space Sci., Univ. of Texas, Dallas, TX, USA), W.A.Abdou.
J. Geophys. Res. (USA), vol.88, no.A9, p.7190-200 (1 Sept. 1983).
The photochemistry of N_2^+ in the daytime F region continues to be a source of concern due primarily to the uncertain roles of the metastable $O^+(^2D)$ ion and possible vibrational excitation. This investigation adopts a unique subset of data from the Atmosphere Explorer C satellite that spans distinct regions near the low-latitude F peak wherein either chemical reactions or electron processes alternatively control the N_2^+ abundances. Concentrations of N_2^+ calculated according to current theory and including recent laboratory data for $O^+(^2D)$ losses via N_2 are found to exceed ionospheric observations between 220 and 400 km by a factor near 2. Relevant characteristics of the basic molecular ion concentration measurements are described, along with an analysis for select orbits conducted according to current photochemical equilibrium theory. (39 refs.)

121444 Parametric excitation and suppression of convective plasma instabilities in the high-latitude *F* region ionosphere. M.J.Keskinen (Plasma Phys. Div., Naval Res. Lab., Washington, DC, USA), P.K.Chaturvedi, S.L.Ossakow.
J. Geophys. Res. (USA), vol.88, no.A9, p.7239-44 (1 Sept. 1983).
Parametric coupling processes of a large-amplitude electromagnetic pump wave with convective plasma fluid instabilities ($\mathbf{E}\times\mathbf{B}$ gradient drift and current convective) in the high-latitude *F* region ionosphere have been studied. It was found that a pump wave, with frequency near the upper hybrid frequency and with electric field component perpendicular to the ambient magnetic field, can stabilize or destabilize the $\mathbf{E}\times\mathbf{B}$ gradient drift and/or current convective instability. For parameters typical of the nighttime high-latitude *F* regiono ionsphere the authors found stabilization or destabilization with a vertically incident *O* mode carrying a free space incident power density of the order of 10^{-4} W/m^2. (44 refs.)

121445 HF direction finding by wave front testing in a fading signal environment. D.W.Rice (Communications Res. Centre, Ottawa, Ontario, Canada).
Radio Sci. (USA), vol.17, no.4, p.827-36 (July-Aug. 1982). [received: Oct. 1983]
Calculations are reported of the probability of observation of various degrees of phase front nonlinearity for two and three signals incident from different directions upon a phase-measuring array. It is assumed that the signals fade independently and that their amplitude probability densities are described by a Rayleigh law. The measure of phase front nonlinearity employed is the RMS deviation from the best straight-line fit to the measured phases along a linear array. Experimental measurements over a 911-km mid-latitude path and a 2100-km auroral-zone path confirm the general behaviour predicted by the theory. (12 refs.)

121446 Automatic calculation of electron density profiles from digital ionograms. II. True height inversion of topside ionograms with the profile-fitting method. Huang Xueqin, B.W.Reinisch (Univ. of Lowell Center for Atmospheric Res., Lowell, MA, USA).
Radio Sci. (USA), vol.17, no.4, p.837-44 (July-Aug. 1982). [received: Oct. 1983]
For pt.I see ibid., vol.17, no.2, p.421-34 (1982). An efficient electron density profile inversion algorithm is developed for use on automatically scaled digital topside ionograms. The profile fitting method models the topside ionosphere with a single polynomial, a method particularly suited for autoscaled data because it is not too sensitive to a certain amount of scatter in the $h'(f)$ data and it makes use of ordinary and extraordinary ray echoes. The program is applied to input data consisting of *O* and *X* trace segments obtained from automatic scaling of a number of digitized ISIS ionograms. (13 refs.)

121447 On the analysis and interpretation of spaced-receiver measurements of transionospheric radio waves. C.L.Rino, R.C.Livingston (SRI Internat., Menlo Park, CA, USA).
Radio Sci. (USA), vol.17, no.4, p.845-54 (July-Aug. 1982). [received: Oct. 1983]
A correlation analysis method developed by Armstrong and Coles (1972) has been applied to spaced-receiver data from the Wideband satellite. The method permits simultaneous estimation of the anisotropy and true drift of the diffraction pattern. The scintillation theory is applied to interpret the measured variations in anisotropy and pattern drift. The results show that in anisotropic media there is a complicated interplay between apparent drifts and the anisotropy of the diffraction pattern that must be accommodated in spaced-receiver data analyses. The method has been applied to verify the *L*-shell aligned, cross-field anisotropy of *F*-region auroral zone irregularities. (21 refs.)

121448 On the application of phase screen models to the interpretation of ionospheric scintillation data. C.L.Rino (SRI Internat., Menlo Park, CA, USA).
Radio Sci. (USA), vol.17, no.4, p.855-67 (July-Aug. 1982). [received: Oct. 1983]
Presents a review of the application of the phase screen model to the interpretation of data from the Wideband satellite (international designation P76-5). The signal structure and experiment configuration allowed measurements of temporal, spatial, and frequency coherence for a wide variety of scintillation conditions. The derived scintillation parameters are in excellent agreement with the phase screen theory. The principal results can be summarized with simple algebraic formulas for the scintillation level, spatial temporal coherence and frequency coherence or coherence bandwith. With appropriate manipulations, the formulas fully accommodate the propagation angle dependence in highly anisotropic media. (62 refs.)

121449 Anomalous absorption effects produced by high power radio waves in the high lattitude ionosphere. T.B.Jones, T.Robinson (Dept. of Phys., Univ. of Leicester, Leicester, England), P.Stubbe, H.Kopka.
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.5/1-9
High power HF radio waves can produce plasma instabilities in the ionosphere which induce major changes in the propagation characteristics of other HF signals propagating through the disturbed region. Experiments to investigate some of these disturbance effects have been undertaken using the Max Planck Institut fur Aeronomie, Lindau heating facility at Tromso, Norway. Particular attention is given to the anomalous absorption effects discovered and to the induced phase changes observed in the diagnostic signals. The observations are interpreted in terms of the plasma instabilities generated and are of interest in assessing the performance of HF communication systems when disturbances of this nature are produced in the ionosphere. (13 refs.)

121450 VHF-long-distance-propagation by auroral backscatter. G.Lange-Hesse (Max-Planck Inst. fur Aeronomie, Katlenburg, Lindau, Germany).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.8/1-14
Extended investigations of VHF auroral backscatter communications had been carried out in Europe in the years from 1958 to 1969 using the results of the observations of beacon transmitters and of an extended network of amateur radio stations covering large parts of Europe. The frequency of occurrence of this kind of propagation as a function of geomagnetic activity and latitude, time of day, season and sunspot cycle is shown by several diagrams. The physical reasons for this backscatter phenomenon and especially for the typical daily variation in the frequency of occurrence are discussed. Proposals are made for special arrangements to suppress this kind of propagation in case of frequency sharing. (52 refs.)

121451 Interference and sharing at medium frequency skywave propagation considerations. J.C.H.Wang (Federal Communications Comm., Washington, DC, USA).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.9/1-13
A considerable amount of work dealing with night time skywave propagation has been done; however, some areas remain to be explored. For example, short-term variation of field strengths has been overlooked. Daytime propagation is far from being quantitatively understood. Also, it is not quite possible to determine interfering signal levels which may be present for a small percentage of time with high accuracy. During sunspot cycles 18 and 19, the Federal Communication Commission conducted an extensive field-strength measurement program in the midlatitude areas of North America. These and

other data are revisited with a new emphasis, namely, interference and sharing. This paper discusses, among other things, determination of field strengths exceeded for different percentages of time (1 to 99%), diurnal variation of field strengths, favorable conditions for daytime skywave propagation, effect of magnetic storms, frequency dependence as observed at daytime and nighttime. (28 refs.)

121452 Anomalous propagation behaviour of radio signals at high latitudes. R.Hunsucker (Geophys. Inst., Univ. of Alaska, Fairbanks, AK, USA).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.11/1-15
Signals in the 3 to 30 MHz (HF) band propagated through polar and auroral ionospheric regions sometimes undergo some unique and profound changes. The channel capacity, intelligibility and reliability of these signals are affected by multipath distortion, backscatter, non-great-circle propagation and other high latitude anomalies. Signals propagated in the VLF, LF, MF, VHF/UHF and microwave portions of the radio spectrum also undergo some very deleterious effects. (59 refs.)

121453 The application of real-time model update by oblique ionospheric sounders to frequency sharing. D.R.Uffelman, L.O.Harnish, J.M.Goodman (E.O. Hulbert Center for Space Res., Naval Res. Lab., Washington, DC, USA).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.12/1-11
Frequency management systems for the high frequencies (HF) currently in use by the US Department of Defense (DoD) rely heavily on manual selection of frequencies which have been allocated on a circuit by circuit basis. There is no capability to anticipate frequency changes (QSYs) in advance in a manner such that a frequency being released by one user can be utilized effectively and immediately by a second user. NRL has been examining a scheme by which a small computer model of the MUF of the HF channel (MINIMUF 3.5) can be made to perform very accurately to anticipate channel characteristics in a short term prediction mode. It is proposed that this model be utilized to provide automated frequency management which would allow one to anticipate frequency availability and thereby allow sharing of frequencies between several users. Utilizing data obtained from an oblique sounder net on the East Coast of the United States, this paper demonstrates the manner in which this might be accomplished. (9 refs.)

121454 The development of an ionospheric model thesaurus and user's guide. J.M.Goodman (E.O. Hulbert Center for Space Res., Naval Res. Lab., Washington, DC, USA).
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.13/1-12
Describes the preliminary progress on the development of a comprehensive survey of ionospheric models—both physical and empirical—which have been, are, or would be employed to evaluate the operation of military radiowave systems. Also to be contained in the survey are forecasting/prediction techniques and propagation effects models together with an evaluation of each based upon available documentation. This work is authorized and funded by the Naval Research Laboratory and promulgated under the aegis and guidance of the NATO-AGARD EPP. (32 refs.)

121455 Fading statistics of C-band satellite signal during solar maximum years (1978-1980). D.J.Fang (Propagation Studies Dept., Comsat Labs., Clarksburg, MD, USA), C.H.Liu.
AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel, Issy-les-Moulineaux, France, 18-22 Oct. 1982 (Neuilly-sur-Seine, France: AGARD 1983), p.30/1-4
From January 1978 to June 1980, scintillation experiments were conducted at the Hong Kong earth station. INTELSAT satellite signals at 4 GHz were received via both the Pacific Ocean Region (POR) and Indian Ocean Region (IOR) satellite-earth links. Severe intensity scintillations with peak-to-peak fluctuations up to 14 dB were observed on many evenings during the equinoctial period. This paper presents detailed statistics of the scintillating signals. The level of fluctuations based on the scintillation index is evaluated, and fading rates in terms of the coherence time are examined and correlated with the level of scintillation. Power spectrum densities are also assessed. The high-frequency asymptotes, i.e. the roll-off slopes at frequencies above the Fresnel frequency, as approximated by f^{-n}, are derived for different levels of fluctuations. For system applications, various cumulative statistics, including annual and worst-month statistics, diurnal variations, and sunsport cycle dependence are summarized. (17 refs.)

AGARD Conference Proceedings No.332. Propagation Aspects of Frequency Sharing, Interference and System Diversity. 31st Symposium of the Electromagnetic Wave Propagation Panel .... See Entry 116930

Observations of odd-half cyclotron harmonic emissions in a shell-Maxwellian laboratory plasma .... See Entry 118710

Annual report for magnetic observatories—1981 .... See Entry 121097

Equivalent ionospheric current systems representing lunar daily variations of the polar geomagnetic field .... See Entry 121102

Theory of radar detection of solitons during ionospheric heating .... See Entry 121398

Simultaneous observations of tropicl arc SAR arc and aurora during geomagnetic storms from IC-Bulgaria-1300 satellite .... See Entry 121423

A statistical study of the dynamics of the equatorward boundary of the diffuse aurora in the pre-midnight sector .... See Entry 121424

A quantitative description of the spatial distribution and dynamics of the energy flux in the continuous aurora .... See Entry 121425

Analytical yield spectrum approach to electron energy degradation in Earth's atmosphere .... See Entry 121426

Simulation of auroral current sheet equilibria and associated V-shaped potential structures .... See Entry 121462

Magnetospheric processes preceding the onset of an isolated substorm: a case study of the March 31, 1978, substorm .... See Entry 121475

The distribution of auroral electrostatic shocks below 8000-km altitude .... See Entry 121479

94.30 PHYSICS OF THE MAGNETOSPHERE

(for planets, see 96.30)

121456 Structure of South Atlantic anomaly in maximum of 21st solar cycle by satellite IC-Bulgaria-1300 data. T.N.Gogosheva (Central Lab. for Space Res., Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.6, p.783-6 (1983).
The anomaly was investigated by a photometer admitting no light—i.e. recording only its dark current. Particles of the South Atlantic anomaly penetrate the photometer causing the dark current to vary. The variation of the dark current over several orbits is discussed. (10 refs.)

121457 Fine structure of the magnetopause based on measurements of the Prognoz-7 and Prognoz-8 satellites. O.L.Vaisberg, A.A.Galeev, L.M.Zelenyi, G.N.Zastenker, A.N.Omel'chenko, S.I.Klimov, S.P.Savin, Yu.I.Ermolaev, V.N.Smirnov, M.N.Nozdrachev.
Cosmic Res. (USA), vol.21, no.1, p.49-55 (Jan.-Feb. 1983). Translation of: *Kosm. Issled. (USSR)*, vol.21, no.1, p.57-63 (Jan.-Feb. 1983). [received: Sept. 1983]
The fine structure of the magnetopause is investigated using data from the SKS-04 instrument on Prognoz-7 and the plasma-wave complex on Prognoz-8. Three crossings of the magnetopause, distinguished by the sharp character of the plasma boundary, are analyzed. Two of these crossings were recorded in the direct transmission mode, making it possible to trace the evolution of the energy spectrum at the plasma boundary. Wave measurements in the ELF range record a burst of lower-hybrid oscillations and determine their role in the formation of the magnetopause structure. (5 refs.)

121458 A study of the plasma mantle in the Earth's magnetosphere. III. Acceleration of ions. N.F.Pisarenko, E.M.Dubinin, A.V.Zakharov, R.Lundin, B.Hiltqvist.
Cosmic Res. (USA), vol.21, no.1, p.56-66 (Jan.-Feb. 1983). Translation of: *Kosm. Issled. (USSR)*, vol.21, no.1, p.64-75 (Jan.-Feb. 1983). [received: Sept. 1983]
For pt.II see Kosm. Issled., vol.20, no.3, p.387-98 (1982), or Cosmic Res., vol.20, no.3, p.281-9 (1982). Data from the Promiks-1 experiment aboard the Prognoz-7 satellite are used to examine the acceleration processes of ionospheric ions. (20 refs.)

121459 Relationship between the intensity of sporadic radio emission of the Earth's magnetosphere in the frequency range 0.7-2.3 MHz and soft electron fluxes (0.2-10 keV). G.M.Artem'eva, V.V.Pisareva, B.I.Savin, A.F.Tarasov.
Cosmic Res. (USA), vol.21, no.1, p.67-72 (Jan.-Feb. 1983). Translation of: *Kosm. Issled. (USSR)*, vol.21, no.1, p.76-82 (Jan.-Feb. 1983). [received: Sept. 1983]
Compares measurements of the intensity of radio emission from the Earth's magnetosphere in the frequency range 0.7-2.3 MHz and irregular soft electron fluxes (0.2-10 keV) obtained by equipment on the Elektron-2 and Elektron-4 satellites. It is found that the nighttime maximum frequency for the appearance of soft electron fluxes falls within regions located near the maximum values for the intensity of sporadic radio emission, except for the premorning sector. (13 refs.)

121460 Small-scale structure of Birkeland currents with anomalous resistance and the problem of thermal balance. V.A.Liperovskii, G.A.Skuridin, S.L.Shalimov.
Cosmic Res. (USA), vol.21, no.1, p.82-91 (Jan.-Feb. 1983). Translation of: *Kosm. Issled. (USSR)*, vol.21, no.1, p.95-105 (Jan.-Feb. 1983). [received: Sept. 1983]
In regions of wave electrostatic turbulence (RWERT) occurring in field tubes with longitudinal currents there is intense turbulent heating of particles. However, according to observations, the temperature of the main part of the plasma stays constant. A possible mechanism is proposed for removing energy from the RWET with ambipolar anomalous diffusion of a small number of high-speed ions which have received energy in the interaction with waves, through the transverse boundaries of the field tubes with currents. The estimates show that the mechanism proposed for removing energy is sufficiently effective for RWET transverse dimensions of the order of a kilometer, and for a boundary layer thickness of the order of Larmor radius for the thermal ions. (26 refs.)

121461 Comparison of spherical double probe electric field measurements with plasma bulk flows in plasmas having densities less than 1 cm^{-3}. F.S.Mozer (Phys. Dept., Univ. of California, Berkeley, CA, USA), E.W.Hones, J.Birn.
Geophys. Res. Lett. (USA), vol.10, no.8, p.737-40 (1983).
Point-by-point comparisons of ISEE-1 spherical double probe dawn-to-dusk electric field measurements and ISEE-2 plasma flows, converted to electric fields, are presented during a three hour time interval in the magnetotail when the plasma density varied from less than 0.1 to about 1 cm^{-3}. The zero lag cross-correlation coefficient between 768 second averages of the two data sets was 0.93. The cross-correlation coefficient decreased with shorter averaging intervals due to the increasing magnitude of statistical uncertainties, becoming 0.49 for 9 second averages. A statistical relative uncertainty between pairs of points in the two data sets, estimated by inclusion only of counting statistics in the plasma measurement and time variations of the observed electric field during the measurement interval, is able to account for at least 75% of the deviations between the two data sets. (10 refs.)

121462 Simulation of auroral current sheet equilibria and associated V-shaped potential structures. N.Singh, H.Thiemann, R.W.Schunk (Center for Atmospheric & Space Sci., Utah State Univ., Logan, UT, USA).
Geophys. Res. Lett. (USA), vol.10, no.8, p.745-8 (1983).
Results from numerical simulations of auroral current sheet equilibria and associated V-shaped potential structures are presented. It is shown that with allowance for both hot magnetospheric ion and cold ionospheric ion populations, the perpendicular potential drop, ϕ_m, associated with a non-neutral auroral current sheet is critically controlled by the temperature of the 'heated' ionosphere ions. The heating is caused by the wave turbulence excited by the auroral current sheet. In the presence of heated ionospheric ions, a relatively large variation in the temperature of the hot magnetospheric ion population causes a very small variation in the potential drop ϕ_m. The perpendicular potential drop acts to produce a V-shaped double layer with multiple potential steps parallel to the magnetic field when a zero potential boundary condition is imposed at the ionospheric boundary. Outside the V-shaped potential structure, ionospheric return currents develop self-consistently. (8 refs.)

121463 Geos 2 plasma drift velocity measurements associated with a storm time Pc5 pulsation. A.D.M.Walker (Dept. of Phys., Univ. of Natal, Durban, S Africa), H.Junginger, O.H.Bauer.
Geophys. Res. Lett. (USA), vol.10, no.8, p.757-60 (1983).
The Geos 2 electron gun experiment has been used to obtain electric field data during the compressional Pc5 pulsation event of Day 300, 1979. The phase relationships between the electric field and magnetic field observations

show that the oscillation in the meridian plane appears to be a transverse Alfven standing wave in the second harmonic, while the compressional oscillation is symmetrical about the equatorial plane. Computations of the fields of a guided poloidal wave fit the transverse oscillation well. The oscillation is not completely explained by existing theories. A comprehensive model of the oscillation is presented. (17 refs.)

121464 Ring coupling model: implications for substorm onsets. N.U.Crooker, G.L.Siscoe (Dept. of Atmospheric Sci., Univ. of California, Los Angeles, CA, USA).
Geophys. Res. Lett. (USA), vol.10, no.8, p.761-4 (1983).
In the ring coupling model the criterion for substorm onset is the narrowing of the auroral oval to some critical limit. The auroral oval is taken to be the annulus bounded by Rings 1 and 2, corresponding to the locations of the Iijima-Potemra Regions 1 and 2 Birkeland currents. It is shown that this criterion is met following both southward and northward turnings of the interplanetary magnetic field (IMF). The behavior of the rings in response to typical variations in the north-south component of the IMF produces a variety of observed substorm sequence patterns. The energy source for substorms in the model is the solar wind energy stored in the magnetotail, whereas the energy for geomagnetic storms comes directly from the solar wind. The model is consistent with the half-wave rectifier response of the magnetosphere to the IMF. (19 refs.)

121465 A theory of long period magnetic pulsations. III. Local field line oscillations. A.Hasegawa (Bell Labs., Murray Hill, NJ, USA), K.H.Tsui, A.S.Assis.
Geophys. Res. Lett. (USA), vol.10, no.8, p.765-7 (1983).
For pt.II see J. Geophys. Res., vol.79, p.1033-7 (1974). A theoretical discussion is presented that supports the conjecture of a wide band source to excite harmonics for a given field line. That is, the local field line can in fact oscillate at its resonant frequency in response to a wide band source whose frequency spectrum covers the resonant frequency(ies). (11 refs.)

121466 Solar wind stream characteristics and low latitude geomagnetic field changes. G.K.Rangarajan (Indian Inst. of Geomagnetism, Bombay, India).
Indian J. Radio & Space Phys., vol.12, no.3, p.65-7 (June 1983).
The passage of high speed solar wind streams past the Earth enhances geomagnetic activity. The equatorial magnetic field changes associated with passage of solar wind streams of different durations density spike and stream interfaces are computed. This reveals that the maximum field change is associated with the short duration streams. The diurnal asymmetry of the disturbance is least for the stream interface passage. However, a significant enhancement of the daily range is found to be associated with the diurnal asymmetry of the disturbance. (8 refs.)

121467 Pi 2 pulsations in the Indian equatorial region. T.S.Sastry, Y.S.Sarma, S.V.S.Sarma, P.V.S.Narayan (Nat. Geophys. Res. Inst., Hyderabad, India).
Indian J. Radio & Space Phys., vol.12, no.3, p.77-80 (June 1983).
Well-defined waveforms and the dominance of H_x component are the general characteristic features of the Pi 2 pulsations in the equatorial regions. The authors, besides bringing out these features, also indicate some specific differences between the events appearing at widely separated stations in the Indian equatorial region. The study entails a comparison of Pi 2 events recorded at the two stations, Choutuppal (geomag. lat. 7° and Etaiyapuram geomag. lat. $-0.6°$) during 1976, the data being restricted to the events that occurred during nighttime (1800-0600 hrs LT). The results are suggestive of induction effects due to a subsurface conductivity anomaly in the neighbourhood of Etaiyapuram, besides possible effects due to the nearby coast. (12 refs.)

121468 Structure of the quasi-parallel bow shock: results of numerical simulations. J.R.Kan, D.W.Swift (Geophys. Inst., Univ. of Alaska, Fairbanks, AK, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.6919-25 (1 Sept. 1983).
Quasi-parallel bowshock structures are simulated by using a one-dimensional nonperiodic hybrid code in which the ion dynamics are treated exactly while the electron dynamics are omitted by neglecting the electron inertia ($m_e=0$) and pressure. The simulations are initialized with the upstream condition specified by $\theta_1=10°$, $\beta_1=0.5$, and $M_{A1}=2$ with 0.5 increment while the downstream condition is obtained from the Rankine-Hugoniot relations, where θ_1 is the angle between the shock normal and the magnetic field, β_1 is the ratio of kinetic to magnetic pressures, and M_{A1} is the Alfven Mach number. The simulations describe a number of phenomena including upstream and downstream waves, turbulent magnetic field structure, firehose instability effects and ion heat flux flowing upstream. (32 refs.)

121469 Numerical simulation of the dayside reconnection. M.Hoshino, A.Nishida (Inst. of Space. & Astron. Sci., Tokyo, Japan).
J. Geophys. Res. (USA), vol.88, no.A9, p.6926-36 (1 Sept. 1983).
To examine the basic characteristics of reconnection on the dayside magnetopause, the authors have numerically studied the reconnection process at an interface where the total pressure is in balance but where the thermal pressure is higher on one side than on the other. Reconnection is caused by anomalous resistivity that is assumed to operate only in a localized region at the interface. Boundaries are assumed to be free boundaries, but reflection of the perturbations originating from inside the simulation region is suppressed by placement of an absorbing region. Results can be expressed as follows, denoting the high-pressure and low-pressure regions as magnetosheath and magnetosphere, respectively. (1) a slow shock is formed in magnetosheath and a slow expansion fan is formed in magnetosphere; (2) at the slow shock the Lorentz force and pressure gradient are of comparable importance in accelerating plasma, but at the expansion fan the pressure gradient has the dominant effect. (12 refs.)

121470 Interaction of ring current ions with the magnetopause. M.Scholer (Inst. fur Extraterrestrische Phys., Max-Planck-Inst. fur Phys. und Astrophys., Garching, Germany), F.M.Ipavich.
J. Geophys. Res. (USA), vol.88, no.A9, p.6937-43 (1 Sept. 1983).
Phase space density observations of ring current protons (30-130 keV) have been analysed during a magnetopause crossing of ISEE 1 on July 5, 1978. Plasma and magnetic field data obtained during this crossing have been reported to be consistent with quasi-steady reconnection and a reconnection line south of the satellite crossing (Sonnerup et al. 1981). The authors find that within the magnetosphere the phase space densities of ~30- to ~65-keV protons are higher for particles streaming parallel to the field (i.e. inflowing particles) than antiparallel to the field (i.e. outward flowing particles). In the magnetosheath the phase space densities parallel to the field are higher than the densities of both outward and inward flowing particles parallel to the field within the magnetosphere. The observations are discussed in terms of acceleration of the reflected and transmitted ring current protons in the magnetopause current layer. (12 refs.)

121471 Low-energy (<100 eV) ion pitch angle distributions in the magnetosphere by ISEE 1. T.Nagai, J.F.E.Johnson, C.R.Chappell (Space Sci. Lab., NASA Marshall Space Flight Center, Huntsville, AL, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.6944-60 (1 Sept. 1983).
Low-energy (<100 eV) ion data from the plasma composition experiment on ISEE 1 are examined statistically to study pitch angle distributions in all local times of the magnetosphere ($L=3$-10). The pitch angle distributions in the data set used can be classified into seven types; however, there are four major types, i.e. isotropic distribution, bi-directional field-aligned distribution, unidirectional field-aligned distribution, and low flux. The isotropic distribution that consists of very low energy (typically <10 eV) ions is a persistent feature in the inner region. It is frequently observed with an accompanying loss cone-like structure. (61 refs.)

121472 Self-consistent theory of three-dimensional convection in the geomagnetic tail. J.Birn, K.Schindler (Ruhr-Univ. Bochum, Bochum, Germany).
J. Geophys. Res. (USA), vol.88, no.A9, p.6969-80 (1 Sept. 1983).
The self-consistent theory of time-dependent convection in the Earth's magnetotail of Schindler and Birn (1982) is extended to three dimensions to include more realistic tail geometry and three-dimensional flow. It is confirmed that a steady state solution implies unrealistic tail geometry or large particle or energy losses that are unrealistic during quiet times. It is concluded therefore that as in the 2-dimensional case the magnetotail becomes time-dependent for typical convection electric fields. Explicit solutions are derived, even analytically, for the three-dimensional flow and the electric and magnetic field in a realistic tail geometry, and quantitative examples are presented. Consequences of time-dependent convection are demonstrated considering two idealized cases of magnetosphere response to solar wind changes. (14 refs.)

121473 Triggering of expansive phase intensifications of magnetospheric substorms by northward turnings of the interplanetary magnetic field. G.Rostoker (Dept. of Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
J. Geophys. Res. (USA), vol.88, no.A9, p.6981-93 (1 Sept. 1983).
Over the past decade evidence has arisen suggesting that northward turnings of the interplanetary magnetic field after an interval of sustained southward IMF can trigger the onset of major substorm expansive phase effects. However, there has been some question in the past as to just how many substorms are triggered and whether, indeed, the correlation of substorm onsets and northward turnings was just a matter of chance. One reason for doubt was that the examples presented in the literature appeared during disturbed periods where the IMS was fluctuating significantly on a time scale of less than one hour and many substorm expansive phase intensifications were observable in the time frame where the correlation between the IMF and ground data was reported. The purpose of this paper is to present three clear-cut examples of isolated substorms where the reader may be able to convince himself of the validity of the reported triggering effect. (17 refs.)

121474 Development of substorm activity in multiple-onset substorms at synchronous orbit. T.Nagai (Space Sci. Lab., NASA Marshall Space Flight Center, Huntsville, AL, USA), D.N.Baker, P.R.Higbie.
J. Geophys. Res. (USA), vol.88, no.A9, p.6994-7004 (1 Sept. 1983).
The development of substorm activity at synchronous orbit (6.6 R_E) for multiple-onset substorms was studied by using the energetic particle and magnetic field data in three local time groups (the afternoon region, the premidnight region, and the postmidnight region). The geostationary spacecraft 1976-059 and 1977-007 provided the measurements of 30- to 2000-keV electrons and 145- to 560-keV protons, GMS the measurements of >2000 keV electrons, and GOES 1 and GOES 2 the measurements of the magnetic field. The ground magnetic variations in a wide area were examined to determine the general characteristics of substorm activity and the timing of various phenomena. The substorm evolutions showed a variety of forms at synchronous orbit. (32 refs.)

121475 Magnetospheric processes preceding the onset of an isolated substorm: a case study of the March 31, 1978, substorm. A.Nishida (Inst. of Space & Astron. Sci., Tokyo, Japan), Y.Kamide.
J. Geophys. Res. (USA), vol.88, no.A9, p.7005-14 (1 Sept. 1983).
Examines in detail the effect of a southward turning of the interplanetary magnetic field (IMF) on the state of the magnetosphere, taking advantage of the availability of the data from IMS magnetometer meridian chains and from several spacecraft. A clear onset substorm occurred on March 31, 1978, when the magnetometer stations were located in the midnight to morning sector and the spacecraft were near the equatorial plane of the nightside magnetosphere. The onset time of the substorm expansion phase could be determined unambiguously in terms of both ground-based magnetic and auroral signatures, and there was an interval lasting about 1 hour between the IMF southward turning and this onset. In this intervening interval the ionospheric current system of the DP 2 type developed. (20 refs.)

121476 Satellite observations of Pi 2 activity at synchronous orbit. T.Sakurai (Dept. of Engng., Tokai Univ., Hiratsuka, Japan).
J. Geophys. Res. (USA), vol.88, no.A9, p.7015-27 (1 Sept. 1983).
Pi 2 magnetic pulsations are frequently observed at synchronous orbit by the UCLA fluxgate magnetometer on ATS 6. Events that occurred in September 1974 have been studied by using digital power spectra and coherency analysis to determine wave characteristics. From examination of wave form and application of spectral analysis, these Pi 2 events can be divided into three types. The first is a superposition of a 100-s oscillation and a large-amplitude, higher-frequency Pi 1 activity. The second is a 100-s wave unaccompanied by Pi 1. Both types have a significant compressional component. The third is a pure transverse wave in the azimuthal component. The pure transverse waves are quite rare, while the compressional waves occur during almost every substorm. The local times of occurrence are studied. Pi 2 polarisations are also studied. (36 refs.)

121477 The localization of Pi 2 pulsations: ground-satellite observations. H.J.Singer, W.J.Hughes (Dept. of Astron., Boston Univ., Boston, MA, USA), P.F.Fougere, D.J.Knecht.
J. Geophys. Res. (USA), vol.88, no.A9, p.7029-36 (1 Sept. 1983).
Much of the attention given to Pi 2 pulsations has resulted from their close relationship with substorm onsets. With few observations in space there are problems in determining the extent of the pulsation region in the magnetosphere and in clarifying the substorm process from information contained in the Pi 2 signal. To further the understanding of Pi 2's and substorms, simultaneous Pi 2 observations from the ground, using the AFGL magnetometer network, and from space, using GOES 2 and 3 satellites, are presented. The observations indicate that the Pi 2 signal in space is often localized such that synchronous satellites separated by 30° see quite different field signatures. In contrast to this, on the ground and mid-latitudes, similar features are often observed across the 60° width of the AFGL magnetometer network. The results are interpreted in terms of the plasma sheet model. (44 refs.)

121478 Occurrence properties of ducted whistler-mode signals from the new VLF transmitter at Siple Station, Antarctica. D.L.Carpenter (Space Telecommunications & Radiosci. Lab., Stanford Univ., Stanford, CA, USA), Z.T.Bao.
J. Geophys. Res. (USA), vol.88, no.A9, p.7051-7 (1 Sept. 1983).
In 1979 a new VLF transmitter was installed at Siple Station, Antarctica ($L\sim4.3$) for the purpose of conducting magnetospheric wave-injection experiments. The transmitter, called Jupiter, is capable of operating at higher power (~7 dB) than the previous system, Zeus, and is also more flexible with respect to modulation. During the austral winter of 1980, signal receptions at the conjugate receiving station Roberval, Canada and in the two-hop mode at Siple itself were exceptional by comparison to data from previous years, both in terms of diurnal coverage and number of days of signal reception. One of the purposes of this paper is to describe and interpret the occurrence features of these data. Another purpose is to compare the occurrence rate of observed signals from Zeus with those from the higher-powered Jupiter system. (24 refs.)

121479 The distribution of auroral electrostatic shocks below 8000-km altitude. E.L.Bennett, M.Temerin, F.S.Mozer (Space Sci. Lab., Univ. of California, Berkeley, CA, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.7107-20 (1 Sept. 1983).
Examines the distributions and characteristics of electrostatic shocks as observed by the S3-3 polar-orbiting satellite. There is auroral oval coverage by the satellite at all magnetic local times and at all altitudes between 240 and 8000 km. Electrostatic shocks are reasonably uniformly distributed in magnetic local time, with a slight increase in the probability of occurrence in the cusp region and a decrease in the post-midnight region. The occurrence of shocks increases sharply with altitude up to 5000 km, and at a slower rate above 5000-km altitude. Larger shocks tend to occur above 5000-km altitude and between 16 to 22 hours magnetic local time. Electrostatic shocks occur in or near the latitudes of the auroral oval, with few shocks occurring inside the polar cap. The authors describe further occurrence statistics and relations. (29 refs.)

Observations of odd-half cyclotron harmonic emissions in a shell-Maxwellian laboratory plasma .... See Entry 118710

Annual report for magnetic observatories—1981 .... See Entry 121097

Energetic electron precipitation due to gyroresonant interactions in the magnetosphere involving coherent VLF waves with slowly varying frequency .... See Entry 121435

The effect of local perturbations of the geomagnetic field on cosmic ray cutoff rigidities at Jungfraujoch and Kiel .... See Entry 121482

Annual variation of number of days of the IMF polarity .... See Entry 121493

94.40 COSMIC RAYS

Cosmic ray data transmission using the if-800 personal computer system .... See Entry 121541

94.40C Origin and propagation outside the solar system

121480 Southern hemisphere cosmic-ray anisotropy at 10^{16} eV. P.R.Gerhardy, R.W.Clay (Phys. Dept., Univ. of Adelaide, Adelaide, Australia).
J. Phys. G (GB), vol.9, no.10, p.1279-87 (Oct. 1983).
Measurements have been made of the anisotropy of cosmic rays with energies of about 10^{16} eV from a Southern Hemisphere (latitude 35°S) site. A sidereal anisotropy with an amplitude of 0.84% and a phase of 8.0 h was found. This phase changes appreciably at about 10^{16} eV. (22 refs.)

121481 Distributed acceleration of cosmic rays. R.Silberberg, C.H.Tsao (E.O. Hulburt Center for Space Res., Naval Res. Lab., Washington, DC, USA), J.R.Letaw, M.M.Shapiro.
Phys. Rev. Lett. (USA), vol.51, no.13, p.1217-20 (26 Sept. 1983).
It is proposed that the acceleration of cosmic rays is distributed over their propagation through interstellar space. Thus after most nuclear fragmentation reactions in the interstellar medium, cosmic rays gain about a factor of 5 in energy. This hypothesis resolves several discrepancies in composition at different energies. The present results suggest that after the principal acceleration and during their galactic confinement, cosmic rays are further accelerated by the weak shocks of widely distributed old supernova remnants. (26 refs.)

94.40E Interplanetary propagation and effects

Absorption of energetic protons by Saturn's Ring G .... See Entry 121593

94.40H Energetic solar particles and photons

Simultaneous acceleration of electrons and ions in solar flares .... See Entry 121646

Successive electron and ion accelerations in impulsive solar flares on 7 and 21 June 1980 .... See Entry 121647

94.40K Solar modulation and geophysical effects

121482 The effect of local perturbations of the geomagnetic field on cosmic ray cutoff rigidities at Jungfraujoch and Kiel. E.O.Fluckiger (Phys. Inst., Univ. Bern, Bern, Switzerland), D.F.Smart, M.A.Shea.
J. Geophys. Res. (USA), vol.88, no.A9, p.6961-8 (1 Sept. 1983).
The effect of local perturbations of the geomagnetic field on the vertical cosmic ray cutoff rigidities at Jungfraujoch and Kiel have been investigated as representative mid-latitude neutron monitor stations. The main, effective, and Stormer vertical cutoff rigidities and their changes were determined by utilizing the trajectory-tracing technique in a magnetic field which is modeled as a simple dipole field to which the disturbance field is superposed. It was found that the cosmic ray cutoff rigidities are most sensitive to variations of the z component of the geomagnetic field at geomagnetic latitudes $-20°<\Lambda<+30°$ and at longitudes within 90° to the east of these northern hemisphere stations. Furthermore, cutoff rigidity variations at Kiel are predominantly due to changes of the geomagnetic field within geocentric distances $2.5R_E<r<6R_E$, whereas at Jungfraujoch changes in cutoff rigidities are caused almost exclusively by magnetic disturbances within $1R_E<r<4.5R_E$. (15 refs.)

Southern hemisphere cosmic-ray anisotropy at 10^{16} eV .... See Entry 121480

Cosmic ray anisotropy derived from air showers ($10^{13}\sim10^{14}$ eV) observed in the southern hemisphere .... See Entry 121485

Vertical sea level muon spectra at super high energies calculated from the recent primary cosmic ray spectrum .... See Entry 121487

94.40L Composition and energy spectra

121483 Mass composition of primary cosmic rays at energies 10^{14}-3×10^{15} eV. J.Kempa (Dept. of Phys., Univ. of Lodz, Lodz, Poland), J.Wdowczyk.
J. Phys. G (GB), vol.9, no.10, p.1271-7 (Oct. 1983).
The flux of hadrons at energies around 10^{13}-10^{14} eV measured by the Mount Fuji experiment has been compared with fluxes predicted for different assumptions about the mass composition of primary cosmic rays. It is shown that agreement between experimental data and prediction can be obtained only if the average mass of the primaries does not increase significantly up to a few times 10^{15} eV. It is concluded that the changes in the picture of cosmic-ray propagation, considered by some authors as due to enrichment of the primary flux by heavy-mass nuclei, have to be interpreted rather in terms of the interaction properties of high-energy hadrons. (17 refs.)

Distributed acceleration of cosmic rays .... See Entry 121481

Vertical sea level muon spectra at super high energies calculated from the recent primary cosmic ray spectrum .... See Entry 121487

94.40N Extensive air showers

121484 Is there a nonrandom component in high-energy cosmic rays?. G.R.Smith, M.Ogmen, E.Buller, S.Standil (Dept. of Phys., Univ. of Manitoba, Winnipeg, Canada).
Phys. Rev. D (USA), vol.28, no.7, p.1601-3 (1 Oct. 1983).
A search for a nonrandom component in the cosmic radiation has been conducted using a ground-based air-shower array sensitive to cosmic-ray primaries of energy $\gtrsim9\times10^{14}$ eV. The time interval between the detection of successive air showers has been measured for more than 156000 air showers recorded over a period of three years. The data are consistent with the conclusion that these primary particles are incident upon the upper atmosphere randomly in time and uniformly from all portions of the sky swept by the array. (10 refs.)

121485 Cosmic ray anisotropy derived from air showers ($10^{13}\sim10^{14}$ eV) observed in the southern hemisphere. K.Murakami, Z.Fujii, T.Yamada, S.Sakakibara.
Proc. Cosmic-Ray Res. Lab. Nagoya Univ. (Japan), vol.26, no.1, p.27-35 (Feb. 1983). In Japanese.
Reviews previous studies of cosmic ray anisotropy, examines the diurnal variation of cosmic rays in both hemispheres and presents results of measurements made at Liawenee, Tasmania, using 288 proportional counters covering an area 72 m^2 and sensitive to a primary median energy 5×10^{13}-10^{14} eV during the period 1981 Dec.-1982 June. (2 refs.) *M.J.C.*

121486 Study of some aspects of extensive air showers at sea level. M.J.Enderby.
Univ. Durham, England thesis, Dec. 1982
An experiment to search for tachyons, associated with extensive air showers, using an unshielded plastic scintillator is described. No evidence for their existence has been found. A review of tachyon theory and previous searches is given. The design and implementation of an automatic data collection system for the Durham Air Shower Array, using a PET microcomputer, is described. In addition various improvements to the array are described. The performance of the array and the methods of data analysis are discussed. The array has been operated with five detectors and the results compared to those expected by simulation. The power of the zenith angle distribution has been determined and found to correspond to previous determinations. The size spectrum has also been determined in the range 2×10^4 to 10^6 electrons. Although the slopes are in agreement with other measurements the absolute rate is low. It is concluded that this is mainly due to the lack of redundancy in the array and that more detectors are required.

Southern hemisphere cosmic-ray anisotropy at 10^{16} eV .... See Entry 121480

Muon component of extensive air showers .... See Entry 121488

94.40R High-energy interactions

Vertical sea level muon spectra at super high energies calculated from the recent primary cosmic ray spectrum .... See Entry 121487

94.40T Muons and neutrinos

121487 Vertical sea level muon spectra at super high energies calculated from the recent primary cosmic ray spectrum. D.P.Bhattacharyya, P.Pal (Dept. of Theoretical Phys., Indian Assoc. for the Cultivation of Sci., Calcutta, India).
Fizika (Yugoslavia), vol.15, no.3, p.283-97 (July-Sept. 1983).
The vertical sea level muon spectrum has been calculated from the recent primary cosmic ray spectrum. On assuming the validity of accelerator data in the fragmentation region for $x>0.1$ in the framework of Feynman scaling and using the meson atmospheric diffusion equation the authors have estimated the muon flux at first generation of parents from $pp\rightarrow\pi^{\pm}X$, $pp\rightarrow K^{\pm}X$, $\pi p\rightarrow\pi^{\pm}X$ inclusive reaction sources and second generation from $pp\rightarrow K^{\pm}X$ inclusive reaction increases with muon energy. The flux of muons for second generation and third generation for $pp\rightarrow\pi^{\pm}X$ inclusive reaction decreases with energy. The derived differential muon spectrum below 1 TeV is well in agreement with the direct magnetic spectrograph data of Holmes et al. (1961), Allkofer et al. (1971), Nandi and Sinha (1972), Ayre et al. (1975). (34 refs.)

121488 Muon component of extensive air showers. C.C.Shelley.
Univ. Nottingham, England thesis, 1982
The Haverah Park Air Shower Array detects and measures air showers initiated by primary cosmic rays with energies in excess of 5×10^{16} eV. The work presented in this thesis concerns the measurement of muon particle densities recorded by the three Nottingham University muon detectors for air showers in the energy range 10^{17} to 10^{18} eV. The muon density measurements were used to establish a muon lateral distribution function in the radial distance interval $80<r<700$ m. The muon lateral distribution function enabled fluctuations in the muon density to be measured. These results are compared with the results of model calculations. The conclusion drawn is that the primary cosmic ray flux is enriched by heavy nuclei. The average values of the muon density/deep water Cerenkov particle density are measured and

the fluctuation width determined. These data, when compared with model calculations, support the conclusion drawn from the muon density calculations. Fluctuations in muon density and muon/Cerenkov ratio are correlated with other air shower parameters measured at Haverah Park in an attempt to verify the relative development characteristics expected from model calculations.

94.40V Cosmic-ray effects in meteorites and terrestrial matter

Sunrise effect on long wave propagation along the Tashkent-Patiala path .... See Entry 121430

Recent cosmic ray exposure history of ALHA 81005 .... See Entry 121619

94.60 INTERPLANETARY SPACE

(see also 96.60 Solar physics)

121489 A determination of the electron density fluctuation spectrum in the solar wind, using the ISEE propagation experiment. L.M.Celnikier (Lab. d'Astronomie, Univ. Paris VI, Paris, France), C.C.Harvey, R.Jegou, M.Kemp, P.Moricet.
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.293-8 (Oct. 1983).
The ISEE propagation experiment is used to obtain a new determination of the electron density fluctuation spectrum in the free solar wind in the vicinity of the Earth. The preliminary analysis suggests that a single, Kolmogorov-type power law spectrum does not fit the data adequately over the entire range of distance scales covered by the experiment, which extends from about 10^2 km: the spectrum appears to flatten for wavelengths shorter than about 4000 km. (20 refs.)

121490 Electromagnetic lower hybrid waves in the solar wind. E.Marsch, T.Chang (Center for Space Res., MIT, Cambridge, MA, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.6869-80 (1 Sept. 1983).
An analysis of electromagnetic lower hybrid waves or hybrid whistlers that propagate nearly perpendicular to the magnetic field lines in the solar wind is described. Doppler-shifted, these waves have a broadband nature when observed in the spacecraft frame depending on the direction of propagation and the supersonic flow velocity of the wind. Lower hybrid waves can energize ions normal to the interplanetary magnetic field. They may occasionally be responsible for the observed temperature anisotropy in high speed streams and possibly for the acceleration of heavier ions such as the oxygen ions, alpha particles, etc. These modes are probably driven unstable by the anisotropic halos of the solar wind electron distributions exhibiting 'heat flux' profiles. (42 refs.)

121491 Collisional modification to the exospheric theory of solar wind halo electron pitch angle distributions. D.S.Lemons, W.C.Feldman (Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.6881-7 (1 Sept. 1983).
A theoretical model of suprathermal halo or strahl solar wind electrons, including both binary collisions and conservative force fields, is proposed. From this model the collisionally modified electron pitch angle distribution is derived and compared with relevant measurements made in the solar wind at 1 AU by using the Los Alamos IMP 8 plasma analyzer. Although the collisionally modified distribution is more isotropic than that predicted by simple exospheric theory, it is not isotropic enough to describe the measurements. (14 refs.)

121492 Removal of velocity bias in the interpretation of measurements of the azimuthal component of the interplanetary magnetic field. M.Eyni, R.Steinitz (Dept. of Phys., Ben Gurion Univ., Beer Sheva, Israel).
J. Geophys. Res. (USA), vol.88, no.A9, p.7236-8 (1 Sept. 1983).
Parker's model for the interplanetary magnetic field predicts an r^{-1} dependence for the azimuthal component. Departures from this relation were indicated in an analysis of a subset of the Helios 1 data. As in a previous analysis of Pioneer 10 data, these departures can be traced to velocity bias. The present authors examine the decrease in solar wind speed which occurred as Helios 1 approached the Sun and thus simulated a steeper gradient of the azimuthal magnetic field component. A simple linear fit between flow speed and distance from the Sun enables the authors to remove from the data most of the velocity bias present. This procedure substantially improves the agreement between Parker's model and the Helios data. (15 refs.)

121493 Annual variation of number of days of the IMF polarity. K.Fujimoto, H.Kojima.
Proc. Cosmic-Ray Res. Lab. Nagoya Univ. (Japan), vol.26, no.1, p.1-11 (Feb. 1983). In Japanese.
Investigates the polarity changes of the interplanetary magnetic field during the period 1947-80 and examines the inclination and lag of the Earth's neutral sheet over three solar cycles. (5 refs.) *M.J.C.*

121494 Interplanetary plasma concentration measurements by use of dual frequencies from separated sites. T.A.Croft, W.A.Edson (SRI Internat., Menlo Park, CA, USA).
Radio Sci. (USA), vol.17, no.4, p.773-85 (July-Aug. 1982). [received: Oct. 1983]
Since 1965 the dual-frequency method has been used for measuring densities of plasmas near planets and in interplanetary space. Two markedly different sets of equipment have thus far been used to perform dual-frequency observations; their strengths and weaknesses are reviewed, and it is shown that many of the weaknesses could be overcome by using separate sites on the Earth from which to transmit the low and high frequencies. A survey of the expected error in measurements using separated sites suggests that the critical element if time synchronization between them. The best available device for performing this function is the cesium beam clock. (18 refs.)

121495 Solar-wind turbulence spectrum and velocity at elongations of 90-150°. V.P.Bovkun, I.N.Zhuk (Inst. of Radiophys. & Electronics, Acad. of Sci., Ukrainian SSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.7, p.513-18 (July 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.7, p.727-33 (July 1982). [received: Sept. 1983]
Research results are presented on the energy spectra of scintillation on inhomogeneities of the interplanetary plasma and ionosphere in the decameter wavelength range. The possibility of separating them is demonstrated. The scintillation spectra of radio sources at 12.6-25 MHz have a power-law form with a spectral index of 3.1 ± 0.6 for interplanetary scintillations and 3.4 ± 0.5 for ionospheric scintillations. No significant drift of the cut frequency of the Fresnel filter was detected in observations of interplanetary scintillations of less than 2 h. The scatter of the instantaneous spectra is mainly due to random fluctuations. Significant drifts of the cut frequency of the Fresnel filter are observed in measurement sessions differing from each other by more than a day. An estimate of the effective solar wind speed of 300 ± 80 km/sec at elongations of 90-150°, which agrees well with the literature data, is obtained using the phase-screen model. (25 refs.)

Solar wind stream characteristics and low latitude geomagnetic field changes .. .. See Entry 121466

Structure of the quasi-parallel bow shock: results of numerical simulations .... See Entry 121468

Triggering of expansive phase intensifications of magnetospheric substorms by northward turnings of the interplanetary magnetic field .... See Entry 121473

Magnetospheric processes preceding the onset of an isolated substorm: a case study of the March 31, 1978, substorm .... See Entry 121475

Nature of the magnetic fields near Mars .... See Entry 121565

Radio emission signature of Saturn immersions in Jupiter's magnetic tail .... See Entry 121592

The interaction of comets with solar radiation and the solar wind. I .... See Entry 121599

94.80 AEROSPACE FACILITIES AND TECHNIQUES; SPACE RESEARCH

(see also 87.65 Aerospace biophysics and medical physics)

121496 Nonequilibrium radiative heating of an ablating Jovian entry probe. S.N.Tiwari, S.V.Subramanian (Old Dominion Univ., Norfolk, VA, USA).
AIAA J. (USA), vol.21, no.9, p.1338-44 (Sept. 1983).
The influence of nonlocal thermodynamic equilibrium (NLTE) radiative transfer on the entire range of shock-layer flow phenomena around a Jovian entry body is investigated. The entry body considered is a 35 deg hyperboloid. The flow in the shock layer is assumed to be viscous, axisymmetric, laminar, and in chemical equilibrium. With coupled ablation carbon-phenolic injection, 16 chemical species are used in the ablation layer for radiation absorption. The NLTE radiative transfer and flux equations are expressed in terms of the NLTE source function, collisional relaxation time, and radiative lifetime. The NLTE results obtained for the peak-heating entry conditions are compared with corresponding equilibrium results. The results indicate that, in the presence of the ablative products, the radiative heating to the entry body is significantly higher under NLTE conditions. (23 refs.)

121497 High-accuracy orbit determination for spacecraft in low Earth orbits. J.M.Dow (Orbit Attitude Div., European Space Operations Centre, Darmstadt, Germany).
ESA Bull. (France), no.35, p.82-9 (Aug. 1983).
With the continuing development of high-precision tracking techniques for near-Earth orbiters (lasers, improved two-frequency microwave range and range-rate systems, satellite-to-satellite tracking, altimetry, plus water-vapour radiometers for correction of tropospheric delays), new standards of accuracy for orbit determination are becoming possible, at the level of decimetres or better. From global tracking of such orbiters many other parameters of geophysical interest in addition to the orbital parameters can be extracted from the tracking data, some examples being gravity coefficients, coordinates of networks of ground points, polar motion, Earth rotation, and tidal parameters. (no refs.)

121498 The future for communication satellites of the PAM-D/half Ariane class. U.Renner (ESA, ESTEC, Noordwijk, Netherlands).
Space Commun. & Broadcast. (Netherlands), vol.1, no.2, p.145-54 (July 1983).
There is a growing market for satellites of the so-called 'medium class' compatible with launch by Delta, Ariane, and the US Space Shuttle. The current market situation and main competing designs are reviewed and predictions made of the trend which can be seen for development of this class of satellites to meet future communication satellite market demands. (no refs.)

121499 Design evolution and economics of future communication satellite platforms. D.E.Koelle (Space Div., MBB-ERNO, Ottobrunn, Germany).
Space Commun. & Broadcast. (Netherlands), vol.1, no.2, p.155-72 (July 1983).
The author first analyzes the trend in the past 20 years regarding communication satellite mass, capacity and number and extrapolates the future trends for European satellite services. Secondly, the author deals with the impact of launch vehicle constraints and requirements on communication satellite design (mass, volume, diameter) and compares different transfer modes LEO*→GEO* in terms of performance and cost efficiency. An assessment of future communication satellite/platform concepts is made, introducing a mass classification and basic spacecraft 'generations'. The different types of conventional spacecraft, platforms with integrated transfer propulsion, modular platform assemblies and large telecom stations are discussed. Finally, the author looks at spacecraft and launch cost, showing the impact of size on cost. Larger, high-capacity systems tend to lower specific cost per channel, promising overall programmatic criteria. (5 refs.)

121500 Trends in propulsion systems for communications satellites. D.E.Fritz (Subsystem Engng. Section, TRW Space & Technol. Group, Redondo Beach, CA, USA), R.L.Sackheim, H.Macklis.
Space Commun. & Broadcast. (Netherlands), vol.1, no.2, p.173-88 (July 1983).
Communications satellite propulsion system performance has been improving steadily for some time. This trend is occurring both for orbit injection propulsion systems and on-orbit attitude and velocity control systems. For injection functions, emphasis has been on higher performance solids with specific impulse values exceeding 300 s, as well as integral liquid systems offering I_{sp} values greater than 310 s. Improved performance for solids is being achieved through use of higher energy propellants and extendable, higher area ratio nozzles. Liquid apogee motors using nitrogen tetroxide (N_2O_4) as oxidizer and monomethylhydrazine (MMH) as fuel are already performing well on the current generation of satellites. On-orbit attitude control systems have progressed through cold gas to monopropellant hydrogen peroxide, to catalytic monopropellant hydrazine. Current satellites achieve weight savings through use of electrothermally augmented hydrazine thrusters for north-south station keeping or all storable bipropellant systems for both velocity and attitude control. The authors describe recent trends in propulsion system designs for near-term and future communication satellites. (5 refs.)

121501 The ITALSAT programme. F.Marconicchio, F.Valdoni (Consiglio Nazionale Richerche, Rome, Italy).
Space Commun. & Broadcast. (Netherlands), vol.1, no.2, p.199-204 (July 1983).
Describes the experimental and pre operational Italsat Programme which has been conceived to prepare for implementation of a subsequent operational Italian domestic system. Such a system is expected to play an important role

in the evolution of an Italian Integrated Services Digital Network (ISDN). (no refs.)

121502 **Study of charged-particle dynamics during ejection of a reactive jet under orbital flight conditions.** V.V.Skvortsov.
J. Appl. Mech. & Tech. Phys. (USA), vol.23, no.6, p.751-7 (Nov.-Dec. 1982). Translation of: *Zh. Prikl. Mekh. & Tekh. Fiz. (USSR)*, vol.23, no.6, p.22-30 (Nov.-Dec. 1982). [received: Sept. 1983] (7 refs.)

121503 **Satellite orbital precession caused by a rotating oblate atmosphere with a diurnal variation in density.** W.J.Boulton (Dept. of Maths., Univ. of Aston, Birmingham, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1797, p.349-67 (8 Oct. 1983).
The effect of the motion of the upper atmosphere on satellite orbits of small eccentricity, $e<0.2$, is considered. The atmospheric model allows for oblateness, and has a density profile that approximates to the observed day-to-night variation. The equations governing the changes due to zonal (west-to-east) and meridional (south-to-north) winds in the right ascension of the ascending node of the orbital plane Ω during one anomalistic period of the satellite are integrated, assuming that H, the density scale-height, is constant. The resulting expressions for $\Delta\Omega_w$, due to zonal winds, and $\Delta\Omega_{\Phi}$, due to meridional winds, are given. It is shown that there can be appreciable changes in $\Delta\Omega/\Delta T_D$, where ΔT_D is the corresponding change in orbital period, that persist for several months for certain resonant orbits if the diurnal variation in density is allowed for. Compact expressions for $\Delta\Omega$ and $\Delta\Omega/\Delta T_D$ are given when H varies linearly with height. It is demonstrated that in general there is no constant value of H that gives an exact equivalence between the variable-H and constant-H equations in the presence of a diurnal density variation. (29 refs.)

121504 **The advance of the perigee of a satellite in a rotating oblate atmosphere with a diurnal variation in density.** W.J.Boulton (Dept. of Maths., Univ. of Aston, Birmingham, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1797, p.433-44 (8 Oct. 1983).
The effect of air drag on satellite orbits of small eccentricity, $0.01 \lesssim e \lesssim 0.2$, is considered. A model of the atmosphere that allows for oblateness, and in which the density behaviour approximates to the observed diurnal variation, is adopted. The equation governing the changes due to drag in the argument of perigee ω, during one revolution of the satellite, is integrated with the assumption that the density scale height H is constant. The resulting expression for $e\Delta\omega$ is presented to third order in e. Compact expressions for $e\Delta\omega$ and $e\Delta\omega/\Delta T_D$, where ΔT_D is the corresponding change in the period, are obtained when H is allowed to vary with altitude. It is shown that there is an equivalence between the variable-H and the constant-H equations, provided that the value of H used in the latter is chosen appropriately. (31 refs.)

121505 **Pulse-to-pulse correlation in satellite radar altimeters.** E.J.Walsh (NASA Wallops Flight Center, Wallops Island, VA, USA).
Radio Sci. (USA), vol.17, no.4, p.786-800 (July-Aug. 1982). [received: Oct. 1983]
Pulse-to-pulse correlation in satellite radar altimeters is examined to determine if range jitter in future altimeters could be reduced by increasing the pulse repetition frequency (PRF). Data from the Skylab radar altimeter range tracker configurations are reviewed and a simple curve is developed for the PRF below which decorrelation is assured. An adaptive PRF for future altimeters is recommended to conserve mission power while optimizing data collection during high-sea states. (21 refs.)

121506 **Introduction to Hinotori.** Y.Tanaka (Inst. of Space & Astronautical Sci., Tokyo, Japan).
Sol. Phys. (Netherlands), vol.86, no.1-2, p.3-6 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
The Hinotori mission is dedicated to solar flare observations mainly in the X-ray energy band. The instruments on board conduct (1) hard X-ray imaging of solar flares by means of rotating modulation collimators, (2) wide energy band spectroscopy in the range from 2 keV to several MeV as well as (3) high resolution crystal spectroscopy of iron emission lines. Several hundred flares have been recorded and analyses are under way. A description of Hinotori and the characteristics of the instruments are presented. (2 refs.)

121507 **Solar instruments on the P78-1 spacecraft.** G.A.Doschek (E.O. Hulburt Center for Space Res., Naval Res. Lab., Washington, DC, USA).
Sol. Phys. (Netherlands), vol.86, no.1-2, p.9-17 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
The solar experiment package on the P78-1 spacecraft is described. The satellite was launched on 24 February 1979 by the US Air Force and contains high resolution Bragg crystal spectrometers, hard X-ray proportional counters, and a white light coronagraph. The high resolution spectrometers were built by the Aerospace Corporation and the Naval Research Laboratory. The hard X-ray spectrometers were built by the Aerospace Corporation and the white light coronagraph was supplied by the Naval Research Laboratory. Most of these instruments are still returning data. (19 refs.)

A predictor model for EHF communication satellite system availabilities in the presence of rain .... See Entry 121364

Diversity reception of COMSTAR 19/29 GHz satellite beacons in convective rain climate of Florida, 1978-1981 .... See Entry 121365

Long term cross-polar statistics at 12 and 14 GHz on a 30° slant-path .... See Entry 121366

Fading statistics of C-band satellite signal during solar maximum years (1978-1980) .... See Entry 121455

Comparison of spherical double probe electric field measurements with plasma bulk flows in plasmas having densities less than 1 cm^{-3} .... See Entry 121461

Interplanetary plasma concentration measurements by use of dual frequencies from separated sites .... See Entry 121494

Regularization and linearization of the equations of motion in central force-fields .... See Entry 121514

Systems of synchronous artificial satellites in stable circular orbits .... See Entry 121516

High resolution ultra-violet observations of alpha Lyrae using the University College London balloon-borne telescope system .... See Entry 121527

Deposition of new reflecting layers on mirrors during extra-atmospheric experiments .... See Entry 121532

A finite-volume, adaptive grid algorithm applied to planetary entry flowfields .... See Entry 121583

95.00 FUNDAMENTAL ASTRONOMY AND ASTROPHYSICS, INSTRUMENTATION AND TECHNIQUES AND ASTRONOMICAL OBSERVATIONS

95.10 FUNDAMENTAL ASTRONOMY

121508 **On the current state and future development of astrometry. I.** Ya.S.Yatskiv.
Astrometriya & Astrofiz. (USSR), no.49, p.3-9 (1983). In Russian.
The subject of astrometry is defined and its problems are classified. The current state and future development of astrometry are considered in connection with the application of new observational techniques to this field of science. The first part of the paper deals with the main problem of astrometry, namely the establishment of the inertial coordinate system. (18 refs.)

An axial meridian circle .... See Entry 121528

On the possibility of applying undense reference star frames to determining the optical positions of extragalactic radio sources .... See Entry 121544

Survey of the Astrographic Catalogue from 1 to 31 degrees of northern declination .... See Entry 121549

Photographic positional observations of Venus at the main astronomical observatory of the Ukrainian Academy of Sciences during 1975 .... See Entry 121561

308 astrometric positions of minor planets—in February and March 1981, ESO, La Silla, Chile .... See Entry 121571

381 astrometric positions of minor planets obtained at the GPO telescope of ESO, La Silla, February/March, 1981 .... See Entry 121572

Positions of asteroids obtained with the CERGA Schmidt telescope .... See Entry 121573,

1983 SA .... See Entry 121577

1983 SA .... See Entry 121579

1983 SA .... See Entry 121580

Minor Planet Circulars 8085-8/82 .... See Entry 121581

363 precise positions of asteroids .... See Entry 121582

Improved orbits of three periodic comets: Reinmuth 1, Slaughter-Burnham and Kearns-Kwee .... See Entry 121596

Comet Kowal-Vavrova (1983t) .... See Entry 121605

Comet IRAS (1983o) .... See Entry 121606

Periodic Comet Halley (1982i) .... See Entry 121607

Comet Shoemaker (1983p) .... See Entry 121608

Periodic Comet Crommelin (1983n) .... See Entry 121609

Sounding of the supercorona by decametric radiation of 3C 144 .... See Entry 121639

Programme of studying stellar kinematics in the main meridional section of the Galaxy .... See Entry 121677

Supernova in IOC 1731 .... See Entry 121713

Micrometer measurements of visual binaries .... See Entry 121726

GX 1+4 .... See Entry 121738

Precise positions in the FK^4 system for ten optical counterparts of extragalactic radio sources .... See Entry 121785

95.10C Celestial mechanics

(for dynamics and kinematics of stellar systems, see 98.10)

121509 **Further studies on criteria for the onset of dynamical instability in general three-body systems.** Y.J.Pendleton, D.C.Black (Space Sci. Div., NASA Ames Res. Center, Moffett Field, CA, USA).
Astron. J. (USA), vol.88, no.9, p.1415-19 (Sept. 1983).
Results are presented from a variety of numerical experiments designed to further elucidate conditions under which self-gravitating three-body systems become dynamically unstable. The authors examined the stability of four types of orbital configurations: (1) circular, prograde, and coplanar orbits, (2) circular, retrograde, and coplanar orbits, (3) circular, direct, and inclined orbits, and (4) eccentric, direct, and coplanar orbits. Experiments with circular, prograde, and coplanar orbits corroborate the stability criterion proposed by Graziani and Black (1981) as well as the generalized form of that criterion proposed by Black (1982). Experiments with retrograd orbits were limited to systems where the tertiary body was significantly less massive than the binary bodies and in orbit about the binary as a whole (the so-called 'outer planet' configuration). These retrograde systems are less stable than their prograde counterparts. Results indicate that orbital inclination does not significantly affect stability for 'outer planet' configurations, but that the stability of 'inner planet' configurations, where the tertiary is in close orbit about one member of the binary, is noticeably less so once the relative orbital inclination >50°. The authors find that the onset of dynamical instability is only weakly dependent on the eccentricity of either the binary or tertiary orbit as long as the mass of tertiary is comparable to the reduced mass of the binary. However, the dynamical stability of systems in which the tertiary mass is either much greater or much less than the reduced mass of the binary is a relatively strong function of orbital eccentricity. (11 refs.)

121510 **Determination of minimum distance between orbits of celestial bodies.** Yu.G.Babenko.
Astrometriya & Astrofiz. (USSR), no.49, p.22-6 (1983). In Russian.
A method is suggested for determination of the minimum distance between an elliptic orbit and that of an arbitrary type. The method is based on finding all the singular points of the mutual distance function. (2 refs.)

121511 **The secular accelerations in Gylden's problem.** A.Deprit (NBS, Washington, DC, USA).
Celestial Mech. (Netherlands), vol.31, no.1, p.1-22 (Sept. 1983).
In a two body-problem, any type of variation in time of the Keplerian parameter μ (product of the constant of gravitation G by the reduced mass m) causes a mean secular acceleration in the mean anomaly, but leaves the mean argument of perigee stationary. All asymptotic estimates for mean marginal rates of variation in the osculating elements, that Vinti (1974, 1977) established in the case when G is inversely proportional to the time, are now extended to the most general kind of Gylden systems, and made into exact relations. The role of a Gylden system in explaining the marginal acceleration in the Moon's mean motion is clarified. In addition, separable Gylden systems

are classified from a physical standpoint by the integrals that they admit. (59 refs.)

121512 Motion near quadruple collision in the trapezoidal 4-body problem. E.A.Lacomba (Dept. of Math., Univ. Autonoma Metropolitana, Mexico City, Mexico).
Celestial Mech. (Netherlands), vol.31, no.1, p.23-41 (Sept. 1983). In French.
Continues the study of the trapezoidal 4-body problem, started by (Lacomba, 1981). The dimensions and interconnections of the invariant submanifolds of the equilibrium points in the total collision manifold are studied. The author concludes with the description of some important motions in the problem. The problem is roughly as hard as the zero angular momentum plane 3-body. The principal features of this problem are the nonexistence of triple collisions and the embedding of two simpler problems with one less degree of freedom: the rectilinear trapezoidal, and the retangular problems (the last one only if $\mu=m$). As usual, there are some bifurcations for some values of the mass ratio. They change some of the interconnections. (6 refs.)

121513 Determination of autonomous three-dimensional force fields from a two-parameter family of orbits. G.Bozis (Dept. of Theoretical Mech., Univ. of Thessaloniki, Thesaloniki, Greece).
Celestial Mech. (Netherlands), vol.31, no.1, p.43-51 (Sept. 1983).
Any two of the components X, Y, and Z of an autonomous force field which gives rise to the space orbits $F(x, y, z)=c_1$, $G(x, y, z)=c_2$ are related by a partial differential equation with coefficients depending on the functions F and G. This is a generalization of the corresponding equation for planar orbits (Bozis, 1983). The above partial differential equation is accompanied by the algebraic linear equation in X, Y, and Z expressing the fact that the force vector is lying in the osculating plane at each point of the orbit. The two equations constitute a generalization of the corresponding Szebehely's equations in the three dimensional space (Erdi, 1982). The generalization is meant in the sense that the dynamical system is not necessarily assumed to be conservative. (5 refs.)

121514 Regularization and linearization of the equations of motion in central force-fields. R.Cid, S.Ferrer, A.Elipe (Dept. de Astron., Univ. de Zaragoza, Zaragoza, Spain).
Celestial Mech. (Netherlands), vol.31, no.1, p.73-80 (Sept. 1983).
With the framework of linear and regular celestial mechanics, wide class of central force field problems are considered. The authors take as potential function a polynomial whose variable is the reciprocal of the distance from the origin, and, as regularizing function the square root of a certain reciprocal polynomial, related to the potential function. The relations between the coefficients of both functions, in order to arrive to linear equations, are given. In particular, the case of a quintic polynomial is analyzed, and an application is made to artificial Earth satellites considering harmonics J_2, J_3, J_4. (11 refs.)

121515 Families of spatial periodic orbits of the Hill problem and their stability. M.L.Lidov, V.A.Lyakhova.
Cosmic Res. (USA), vol.21, no.1, p.1-9 (Jan.-Feb. 1983). Translation of: *Kosm. Issled. (USSR)*, vol.21, no.1, p.3-11 (Jan.-Feb. 1983). [received: Sept. 1983]
The results of a numerical determination of the parameters of the families $\mathscr{L}_0$ of spatial periodic orbits of the Hill problem are presented. The families $\mathscr{L}_0$ are generated by certain one-dimensional periodic orbits forming the family $\mathscr{B}_0$. A test particle on the orbits of $\mathscr{B}_0$ moves along a segment of the axis normal to the plane of the orbit of the main bodies. (3 refs.)

121516 Systems of synchronous artificial satellites in stable circular orbits. M.A.Vashkov'yak, M.L.Lidov.
Cosmic Res. (USA), vol.21, no.1, p.9-15 (Jan.-Feb. 1983). Translation of: *Kosm. Issled. (USSR)*, vol.21, no.1, p.12-19 (Jan.-Feb. 1983). [received: Sept. 1983]
Discusses the problem of determining the initial parameters of the motion of a system of satellites in almost-circular, synchronous orbits which ensure that both the path of the Earth's surface and the angular distance between any pair of satellites are stable. Examples of such systems, consisting of systems of three satellites in orbits with initial inclinations $i\approx48$ and 43°, and their stability over a 5-yr period of time are studied. (5 refs.)

121517 Application of time reversal invariance to numerical experiments of many body systems: case of Campbell-Henon model. K.Aizu (Dept. of Phys., Rikkyo Univ., Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.106-18 (July 1983).
The accuracy of numerical experiments in many body systems is examined with the aid of the time reversal invariance. As an example the case of self-gravitating, spherically symmetric system—Campbell-Henon model—is studied. The author compares the initial values of radius and velocity of each particle with the final ones obtained at the end of time-reversed process under different parameters. In typical cases the accuracy rapidly diminishes 8-fold compared to the dynamical time. The method is used to select optimum values of parameters for numerical computations. (6 refs.)

High-accuracy orbit determination for spacecraft in low Earth orbits .... See Entry 121497

Satellite orbital precession caused by a rotating oblate atmosphere with a diurnal variation in density .... See Entry 121503

The advance of the perigee of a satellite in a rotating oblate atmosphere with a diurnal variation in density .... See Entry 121504

The Sun's quadrupole moment and perihelion precession of Mercury .... See Entry 121526

Collisional processes of planetesimals with a protoplanet under the gravity of the proto-Sun .... See Entry 121556

Laboratory exercises in astronomy—the orbit of Mars .... See Entry 121569

Perturbation in the Comet's motion caused by Ceres, Pallas and Vesta .... See Entry 121595

Determination of nongravitational parameters for some periodic comets .... See Entry 121597

On the first transit of nearly parabolic comets across the inner part of the Solar System .... See Entry 121598

Modern view on Laplace's problem .... See Entry 121603

Cometary impacts with the Sun: physical and dynamical considerations .... See Entry 121604

Aphelion clustering of 'new' comets: star tracks through Oort's cloud .... See Entry 121610

Computer simulations of gravitational encounters between pairs of binary star systems .... See Entry 121720

95.30 FUNDAMENTAL ASPECTS OF ASTROPHYSICS

121518 The limits to the cross-section for magnetic monopole creation obtained from the persistence of the magnetic field of white dwarfs. A.K.Drukier (Dept. of Nuclear Medicine, Tech. Univ. Munich, Munich, Germany).
Acta Astron. (Poland), vol.33, no.1, p.127-39 (1983).
The persistence of magnetic fields of white dwarfs suggests that the monopoles with $m_g \leq 4\times10^3$ GeV/c are either nonexistent or 'composite', i.e. that their production is much suppressed. (38 refs.)

121519 Propagation of high frequency waves in strongly magnetized plasmas. Mode ambiguities due to vacuum polarization. M.Soffel, J.Ventura, H.Herold, H.Ruder, W.Nagel (Lehrstuhl fur Theoretische Astrophys., Univ. Tubingen, Tubingen, Germany).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.251-9 (Oct. 1983).
The question of normal mode orthogonality for hot strongly magnetized plasmas, as they might occur in the accretion column of X-ray pulsars, is reexamined. The problem of complete non-orthogonality of the modes ('mode collapse') that may occur near the cyclotron resonance and in the region where the plasma goes from being plasma to vacuum dominated is discussed in detail. Consequences for radiative transport calculations are mentioned. The occurrence of mode collapse in the vicinity of atomic resonances is briefly discussed. (25 refs.)

121520 The statistical behaviour of normalized Stokes parameters. D.Clarke, B.G.Stewart, H.E.Schwarz, A.Brooks (Univ. Obs., Glasgow, Scotland).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.260-4 (Oct. 1983).
It is demonstrated that because of noise, the distribution of repeated measurements of normalized Stokes parameters is not normal, generally exhibiting both skewness and kurtosis with the former possibly introducing systematic errors in the determination of mean values. In the limiting case for which the accuracy of the measurements is controlled by the noise of photon counting statistics, it is shown that the distribution, although symmetric, suffers positive kurtosis. However, except for circumstances which provide low photon counts per sample, the differences from normality are small, hardly affecting the standard determination of confidence intervals. Attention is also drawn to the diversity of ways by which normalized Stokes parameters are calculated. (14 refs.)

121521 Transfer of L_α-radiation in optically thick media. V.V.Zharkova.
Astrometriya & Astrofiz. (USSR), no.49, p.32-9 (1983). In Russian.
L_α-radiation transfer is considered in chromospheric formations of large optical thickness. The transfer equation in L_α line is solved within the framework of the plane-parallel geometry and two-level hydrogen atom. Different physical parameters of the model are considered. Line of sight distributions for the excitation degree of the second level n_2/n_1 and the L_α-profiles are obtained. (16 refs.)

121522 Dynamo generation of magnetic fields in three-dimensional space: solar cycle main flux tube formation and reversals. H.Yoshimura (Dept. of Astron., Univ. of Tokyo, Tokyo, Japan).
Astrophys. J. Suppl. Ser. (USA), vol.52, no.4, p.363-85 (Aug. 1983).
Dynamo processes as a magnetic field generation mechanism in astrophysics can be described essentially by movement and deformation of magnetic field lines due to plasma fluid motions. A basic element of the processes is a kinematic problem. The author investigates the case of the solar magnetic cycle. A simple combination of differential rotation and global convection, given by a linear analysis of fluid dynamics in a rotating sphere, can perpetually create and reverse great magnetic flux tubes encircling the Sun. This shows that magnetic field generation by fluid motions is, in fact, possible and that MHD equations have a new type of oscillatory solution. The solar cycle can be identified with one such oscillatory solution. (80 refs.)

121523 Electron excitation rates among fine structure levels in O III. K.M.Aggarwal (Dept. of Appl. Maths. & Theoretical Phys., Queen's Univ. of Belfast, Belfast, N Ireland).
Astrophys. J. Suppl. Ser. (USA), vol.52, no.4, p.387-98 (Aug. 1983).
Electron collision strengths have been calculated for 146 transitions among the fine-structure levels in O III using a suitable transformation of *LS* coupling reactance matrix elements computed with the *R*-matrix method. These have been obtained at a fine energy grid in an energy region below 5.16 Ry and are found to be varying with electron energy, exhibiting a complicated resonance structure in almost the entire energy range. These have been averaged over a Maxwellian distribution of electron energies to get the effective collision strengths which are very simply related to the excitation and the de-excitation rate coefficients. The results are tabulated for temperatures below 60000K. (17 refs.)

121524 The emission spectrum of yttrium monoxide: new rotational and vibrational results on the $A^2\Pi$-$X^2\Sigma^+$ system. A.Bernard, R.Gravina (Obs. de Lyon, Univ. Claude Bernard, Lyon, France).
Astrophys. J. Suppl. Ser. (USA), vol.52, no.4, p.443-50 (Aug. 1983).
Rotational analyses have been extended to the emission spectra of several more bands in the $\Delta v=0,-1$ sequences of the $A^2\Pi$-$X^2\Sigma^+$ system of yttrium monoxide, excited in the discharge of a hollow cathode tube. The study is now completed for 18 bands, including the six $\Delta v=0$ bands already analyzed from Fourier transform spectroscopy. Accurate positions for 69 band heads are given, 12 of which principally in the $\Delta v=-1$ sequence (up to the 22-23 band) have been observed for the first time. A consistent set of accurate rotational and vibrational constants is obtained for both states, up to $v''=10$ and $v'=9$, from global band fittings, v-connected bands being simultaneously treated. (19 refs.)

121525 Liquid-gas phase transition in nuclear matter. P.J.Siemens (Dept. of Phys., Texas A&M Univ., College Station, TX, USA).
Nature (GB), vol.305, no.5933, p.410-12 (29 Sept. 1983).
In supernovae, in the crucial moments when the implosion is reversed to an explosion, densities comparable to those of neutron stars may be attained with associated temperatures of 5 to 10 MeV. An accurate knowledge of the properties of nuclear matter under these conditions is essential to the understanding of supernova dynamics. This communication shows how laboratory observations with the latest generation of nuclear accelerators can be used to infer the surface tension of the liquid-gas interface in nuclear matter—an essential ingredient of the equation of state for which a reliable theoretical model is not available. (16 refs.)

121526 The Sun's quadrupole moment and perihelion precession of Mercury. L.Campbell, J.C.McDow, J.W.Moffat, D.Vincent (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada).
Nature (GB), vol.305, no.5934, p.508-10 (6 Oct. 1983).
The interior rotation of the Sun is determined from rotational splittings of global oscillations of the Sun. The angular velocity distribution yields the

minimum quadrupole moment coefficient $J_2=1.6\times10^{-6}$. A physical angular velocity distribution will produce a larger J_2 of the order of 5.0×10^{-6}. These results are compared with general relativity and the nonsymmetric theory of gravitation. For $J_2=5.0\times10^{-6}$ it is found that using the radar tracking data for the orbits of Mercury and the minor planet Icarus, general relativity disagrees with the data by $\approx 2^1/_4$ standard deviations. The nonsymmetric gravitational theory can fit all the Solar System data, including the orbits of Mercury and Icarus, if the new post-Newtonian parameter $l_\odot=3.1\times10^3$ km. (20 refs.)

Testing general relativity: 20 years of progress ......See Entry 117069

Branching ratios in the vacuum ultraviolet spectrum of neutral carbon ......See Entry 117821

Temperature dependence of the carbon dioxide photoabsorption cross section between 1200 and 1970 Å ......See Entry 120655

Efficient methods to calculate Chandrasekhar's *H*-functions .See Entry 121543

Formation and photochemistry of methylamine in Jupiter's atmosphere ......See Entry 121587

Fe-Ni-S-O layer phase in C2M carbonaceous chondrites—a hydrous sulphide? ......See Entry 121636

Oscillator strengths of titanium and chromium ionic lines ..... See Entry 121638

Quasiperiodic oscillations in the solar atmosphere ......See Entry 121641

Transonic accretion flow in a thin disk around a black hole. II ......See Entry 121675

Pulsations and viscosity ......See Entry 121678

A model of a neutrino stellar system and the upper bound of neutrino mass obtained from the rotation curves of some galaxies ...... See Entry 121743

Time-dependence chemistry. I. Modelling of a static cloud ....See Entry 121759

On the physics and chemistry of interstellar matter II ......See Entry 121763

The influence of quantum effects on the space-time structure in the neighbourhood of singularities in the general theory of relativity ......See Entry 121796

The cosmological evolution of general Bianchi models in the adiabatic regime ......See Entry 121800

Gravitational instability for a multifluid medium in an expanding universe ......See Entry 121801

Quantum dissipative processes and gravitational entropy of the Universe ......See Entry 121802

Cosmology from higher-dimensional gravity ...... See Entry 121805

Note on Euclidean Bianchi-type 'cosmologies' ......See Entry 121807

95.45 OBSERVATORIES

Mauna Loa sky conditions—bench mark and present ......See Entry 121371

95.55 ASTRONOMICAL INSTRUMENTS

121527 High resolution ultra-violet observations of alpha Lyrae using the University College London balloon-borne telescope system. B.Y.Welsh, A.Boksenberg, B.Anderson, W.A.Towlson (Dept. of Phys. & Astron., Univ. Coll. London, London, England).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.335-40 (Oct. 1983).
Spectral observations at a resolution of 8 km s^{-1} covering the region 2000-3200 Å have been made of the bright star α Lyrae (Vega) using the University College London Balloon-borne Ultraviolet Telescope and Image-tube Spectrograph. The authors report on the in-flight instrument performance and in particular the sensitivity and resolution of the system are discussed. Three important aspects of the present stellar data in the spectral region 2588-3135 Å are presented and these balloon results are subsequently compared and contrasted with other published data for this star. (22 refs.)

121528 An axial meridian circle. G.I.Pinigin, O.E.Shornikov.
Astrometriya & Astrofiz. (USSR), no.49, p.75-82 (1983). In Russian.
A description is given of a new design of the axial horizontal meridian circle. The instrument constants are controlled continually by means of the marks in the prime vertical. A method of stellar coordinates determination is elaborated. (10 refs.)

121529 25-M optical telescope with a mosaic main mirror. N.V.Stechenko.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.170-5 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.161-5 (1981). [received: Oct. 1983]
The design of a 25-m optical telescope with a mosaic main mirror is discussed. The telescope can consist of about 500 sitall mirrors, each 1.2 m in diameter, that are automatically controlled and produce a single image with energy concentration 70-80% within a spot 0.4-0.5 inch in diameter. The assembly of the telescope is briefly described. (10 refs.)

121530 Possible optical design of a telescope with a spherical main mirror 20-24 m in diameter. B.A.Burnasheva, R.E.Gershberg, V.I.Pronik, N.V.Steshenko.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.176-81 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.166-70 (1981). [received: Oct. 1983]
The attainment of high-quality image ($\sim1''$) in the $1'$ field of a two-mirror optical telescope with a spherical main mirror is discussed. It is shown that, in principle, this problem can be solved by introducing a secondary mirror in the form of a convex oblate spheroid or a slightly more complicated shape. Image sizes calculated by the ray-tracing method are reported for systems in which the main mirror has a large relative aperture. For next generation large telescopes with equivalent mirror diameter of 20-25 m, this optical system has considerable advantages as compared with the Cassegrain or Gregorian arrangements. (4 refs.)

121531 examination of concave and convex aspherical mirrors with a T-shaped spherometer. R.E.Gershberg, V.I.Pronik.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.182-93 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.171-9 (1981). [received: Oct. 1983]
The SFERA program is used to compute the data necessary for the fabrication and testing of astronomical mirrors, including the precise mirror figure, its deviation from the initial sphere, the sagittals of this figure for different mountings of the T-shaped spherometer on the surface, and the corresponding radii of the contacting spheres. The basic relationships for the program are introduced. The program can cope with both convex and concave mirrors with surfaces of the second or higher degree. (5 refs.)

121532 Deposition of new reflecting layers on mirrors during extra-atmospheric experiments. A.V.Bruns.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.216-23 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.197-203 (1981). [received: Oct. 1983]
It is suggested that the reflecting properties of mirrors in optical devices used for extra-atmospheric measurements can be restored by depositing reflecting coatings during the operation of these devices in satellite orbits. A simple graphoanalytic method is put forward for calculating the thickness of the deposited layer when several individual evaporators are employed. (5 refs.)

121533 Resolution in astronomy. D.S.Brown (NEI Grubb Parsons, Walkergate, Newcastle-upon-Tyne, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.290-3 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Reviews the resolution currently obtainable at wavelengths shorter than 100 μm and examines the extent to which improved resolution could be obtained with only modest extensions of current technology. The review is confined to consideration of telescope resolution and does not include the performance of detectors. (no refs.)

A fast data recording system for a rotating interferometer ...See Entry 121392

Introduction to Hinotori ......See Entry 121506

Solar instruments on the P78-1 spacecraft ......See Entry 121507

Test runs on the five-channel spectrophotometer on the AZT-8 telescope ......See Entry 121535

Computation of the profile of a surface accurately corrected for spherical aberration on the axis in a centered optical system ......See Entry 121538

Correction of spherochromatism in Schmidt cameras ......See Entry 121539

Computation of polarization parameters of systems by the symbolic method ......See Entry 121545

95.65 AUXILIARY AND RECORDING INSTRUMENTS

121534 Regularities in signal and noise producing processes typical for all pickup tubes of image orthicon class. N.D.Galinskii.
Astrometriya & Astrofiz. (USSR), no.49, p.82-8 (1983). In Russian.
Processes of build-up and readout of the charge pattern on the target in all tubes of image orthicon type (image orthicon, isocon and anti-isocon) can be regarded as successive charging or target capacity during storage and discharging of it during readout. Then peak-to-peak voltage only gradually approximates the steady state. At not too high light levels the frame number required for achieving the steady state appears to be much more than one. This determines the lag of this kind of tube but simultaneously explains the fact that in the case of viewing stationary or slowly moving scenes prereading noise does not achieve the output of the tubes, and the signal-to-noise ratio is determined only by the noise of the useful contribution of the return beam current. (12 refs.)

121535 Test runs on the five-channel spectrophotometer on the AZT-8 telescope. A.B.Bukach.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.224-34 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.204-15 (1981). [received: Oct. 1983]
Field runs have been carried out on the five-channel spectrophotometer with the aim of determining experimental uncertainties and the constancy of the instrumental characteristics in routine operations on a telescope. Extensive experimental data were used to determine the average temperature coefficient of the instrument as a whole. Trial runs have been carried out on a number of stars. Twenty scans recorded at different times and for different temperatures showed that data on stellar spectra, corrected for the temperature coefficient, could be obtained to within better than 1%, and the wavelength could be determined to within 3.5 Å. (11 refs.)

121536 Adaptive optical system for astronomical applications. F.Merkle, J.Bille, K.Freischlad, M.Frieben, G.Jahn, H.-L.Reischmann (Inst. of Appl. Phys. I, Univ. of Heidelberg, Heidelberg, Germany).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.294-302 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
An active mirror was developed which consists of an electrostatically deformable membrane. The polymer foil is actuated by an electrode array with 63 hexagonal elements arranged in a ring structure. With multi-microprocessor control the stabilisation of the star-speckle pattern positions and the deconvolution of the speckle patterns are possible. Two control methods are in development. One is working with a modified shearing interferometer as a wave-front sensor and a feed-back with cross-talk compensation. The other is sensing the optical information in the image plane by a diode-array and computing the wave-front from its Fourier modulus. The system presented is designed for the 0.75 m RC-telescope with alt-azimuth mount at the Landessternwarte in Heidelberg. (10 refs.)

121537 The CCD camera: a revolutionary new astronomical detector. T.C.Weekes (Mt. Hopkins Obs., Amado, AZ, USA).
Irish Astron. J., vol.15, no.4, p.271-80 (Sept. 1982). [received: Sept. 1983] (Proceedings of the Meeting of the Astronomical Science Group of Ireland, Belfast, Northern Ireland, 15 Dec. 1981).
The principle of the CCD detector is discussed, together with its use in astronomy. The advantages and disadvantages are discussed. (no refs.)

Computation of the profile of a surface accurately corrected for spherical aberration on the axis in a centered optical system ......See Entry 121538

Computation of polarization parameters of systems by the symbolic method ......See Entry 121545

95.70 OTHER INSTRUMENTATION AND TECHNIQUES

(inc. clocks, frequency standards)

121538 Computation of the profile of a surface accurately corrected for spherical aberration on the axis in a centered optical system. G.M.Popov.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.194-204 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.180-8 (1981). [received: Oct. 1983]
Simple and rigorous formulas are reported for the profile of the last surface, corrected for spherical abration, on the axis of an arbitary centred optical system. The method used to compute the aspherical surface located in the interior of the system and correcting its spherical aberration is described. A

simple procedure for determining the coma of the system is described and a method is given for correcting it in a special case. Examples are presented of the design of a fast objective of a coronograph and a spectrograph, based on these methods. (6 refs.)

121539 Correction of spherochromatism in Schmidt cameras. R.G.Bingham (Royal Greenwich Obs., Hailsham, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.303-10 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Describes the use of a negative vertex power of chromatic aberration at the corrector, which induces a compensating spherochromatism by changing the incidence height at the mirror surface. Various other aberrations can be corrected. Examples include a solid camera for use with a charge-coupled device as detector in a spectrometer. (8 refs.)

121540 Spot sensitometer for astronomical use. R.P.Edwin (Dept. of Astron. & Astrophys., Univ. of St. Andrews, St. Andrews, Fife, Scotland).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.311-14 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
A sensitometer has been commissioned for the photometric calibration of spectroscopic and wide field astronomical plates. A set of illuminated apertures of various diameters illuminate a corresponding set of apertures all of equal diameter located immediately in front of emulsions. Twenty calibration spots in irradiance steps of 1.27 are exposed on to each plate. Burr-free apertures of precise diameter were photo-etched in thin foil. During periodic calibrations, a fibre-optic feed system is coupled to a photon counting photomultiplier. The instrument is spectrally neutral and spot irradiance ratios are calibrated to within 1%. (6 refs.)

121541 Cosmic ray data transmission using the if-800 personal computer system. H.Ueno, M.Orito, T.Yamada.
Proc. Cosmic-Ray Res. Lab. Nagoya Univ. (Japan), vol.26, no.1, p.37-71 (Feb. 1983). In Japanese.
Describes the design of a data transmission system using two linked minicomputers, an if-800-10 and an if-800-20, connected by modems. Flow charts and BASIC programs listings are provided and the data presentation is explained using cosmic ray intensity data from the Sakashita Underground Observatory processed at Nagoya. (no refs.) *M.J.C.*

examination of concave and convex aspherical mirrors with a T-shaped spherometer .... See Entry 121531

Acousto-optic filters in astronomical spectrophotometry .... See Entry 121546

10^{12} eV radiation from the X-ray source Cyg X-3 observed at Tien Shan in 1977 and 1978 .... See Entry 121736

95.75 TECHNIQUES OF OBSERVATION AND REDUCTION

121542 Automated photographic photometry of stars in globular clusters. R.Buonanno, G.Buscema, C.E.Corsi, I.Ferraro, G.Iannicola (Osservatorio Astronomico su Monte Mario, Roma, Italy).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.278-82 (Oct. 1983).
An automatic method for stellar photometry in crowded fields is presented. The reduction procedure, based on a multicomponent fitting routine, applies to PDS scans of a photographic plate and gives accurate magnitudes of all the objects with a detectable maximum (the estimated internal error is $\sigma \simeq 0.02$ m). The extended objects (galaxies or extremely blended stellar images) are recognized and passed to an interactive procedure. An application to the photometry of 2344 stars in the field of the globular cluster NGC 2808 is also shown. (17 refs.)

121543 Efficient methods to calculate Chandrasekhar's *H*-functions. P.B.Bosma, W.A.de Rooij (Dept. of Phys. & Astron., Free Univ., Amsterdam, Netherlands).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.283-92 (Oct. 1983).
Three iterative methods are proposed to determine the scalar H-functions for nonnegative characteristic functions $\psi(x)$ fulfilling the condition $\int_0 \psi(x)dx \leq {}^1/_2$. The methods are based on the use of the equation $1/H(\mu)=(1-2\psi_0)^{1/2}+\int_0^1[x\psi(x)H(x)]/(\mu+x)d$ x derived by Chandrasekhar. The authors prove that this equation allows two solutions, one being entirely positive—the physically relevant solution—and the other one being entirely negative. This distinct separation of the solutions ensures the uniqueness of the results. For isotropic scattering, linearly anisotropic scattering and Rayleigh scattering the authors present H-functions and some of their moments in 11 significant figures for 6 values of the albedo for single scattering, including the case of conservative scattering. (18 refs.)

121544 On the possibility of applying undense reference star frames to determining the optical positions of extragalactic radio sources. P.F.Lazopenko.
Astrometriya & Astrofiz. (USSR), no.49, p.10-12 (1983). In Russian.
The author considers a method for the determination of plate constants using two reference star frames, AGK3 and $n \approx 3$ nearest to the radio source stars with positions in the FK4 system within an accuracy of $\sigma_f = 0.08''$. By tying the secondary reference star frame and the FK4 system, an accuracy of about $\sigma_f/\sqrt{n} \approx 0.05''$ can be achieved. (5 refs.)

121545 Computation of polarization parameters of systems by the symbolic method. D.N.Rahckovskii, V.I.Abramenko, L.I.Tsvetkov.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.205-15 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.189-96 (1981). [received: Oct. 1983]
The matrix formalism for the transformation of the parameters of polarized radiation is used as a basis for a program algorithm for the computation of the characteristics of polarimetric systems. The symbolic notation introduced into the program is transformed into a specific matrix expression for various modulation frequencies, which are then computed. The procedure has been used to analyze the operation of radio-frequency polarimeters for the centimeter range, used in observations with a RT-22 telescope at the Crimean Astrophysical Observatory of the USSR Acadamy of Sciences. (6 refs.)

121546 Acousto-optic filters in astronomical spectrophotometry. B.Bates, D.Findlay, D.Halliwell (Dept. of Pure & Appl. Phys., Queens' Univ. of Belfast, Belfast, N Ireland).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.369, p.315-18 (1983). [received: Sept. 1983] (SPIE Proceedings of the Max Born Centenary Conference OPTICS 82, ECOSA 82, Edinburgh, Scotland, 7-10 Sept. 1982).
Acousto-optic filters possess some attractive properties for applications to astronomical spectrophotometry. Tuning over a wide spectral range is achieved by variation of the frequency of an acoustic wave propagated through the crystal which causes diffraction of the incident collimated light in a narrow range of wavelengths. Spectral scanning either continuously through the spectrum or by switching to a programmed set of wavelengths can be accomplished easily and rapidly since there are no moving parts. Spectral performance characteristics of a commercially available filter are given and an outline is presented of a prototype astronomical spectrometer which is controlled by a microcomputer. (8 refs.)

121547 A method for the identification and elimination of contamination during carbon isotropic analyses of extraterrestrial samples. P.K.Swart, M.M.Grady, C.T.Pillinger (Dept. of Earth Sci., Univ. of Cambridge, Cambridge, England).
Meteoritics (USA), vol.18, no.2, p.137-54 (30 June 1983).
The study of carbon abundance and isotropic composition in extraterrestrial samples is fraught with problems related to contamination in the terrestrial environment and during sample handling. A stepped combustion method is described which demonstrates that progress can be made towards resolving the indigenous species from contamination which for the most part burns at low temperature ($<425 \pm 25°$). The proposed method is not applicable to samples which have indigenous phases burning at low temperatures. A number of examples where its application is possible are given. (34 refs.)

121548 VRI photometry: an addendum. M.S.Bessell (Mount Stromlo & Siding Spring Obs., Australian Nat. Univ., Woden, Australia).
Publ. Astron. Soc. Pac. (USA), vol.95, no.570, p.480-8 (Aug. 1983).
Single valued transformations are not possible between Johnson *VRI* colors measured using an S1 tube and the original Johnson filters and related *VRI* colors measured using S20 and GaAs tubes. Several effects contribute to this nonequivalence: the Balmer lines, Paschen discontinuity and reddening in hot stars, and metal line and molecule band absorption differences due to luminosity and abundance differences in late-type stars. This shows the importance in broad-band photometry (as in narrow-band photometry) of closely matching the passbands of photometric systems whose standards are to be used. Several Johnson-system *VRI* photometry sets are intercompared and linear transformations derived to the Cousins system. (9 refs.)

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95.80 ASTRONOMICAL OBSERVATIONS (LISTED BY TECHNIQUES OF OBSERVATION)

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A near-infrared and optical study of X-ray selected Seyfert galaxies. I. Observations .... See Entry 121774

New central velocity dispersions for the bulges of 53 spiral and S0 galaxies .... See Entry 121775

CCD surface photometry of two southern active galaxies, NGC 1316 1052 ...... See Entry 121780

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Precise positions in the FK^4 system for ten optical counterparts of extragalactic radio sources .... See Entry 121785

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95.80M Space ultraviolet

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95.80N X-ray

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95.80Q gamma-ray and elementary particle

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Gamma-ray line features from the Crab Nebula in the energy range 5-2000 keV .... See Entry 121756

95.85 CATALOGUES, ATLASES ETC

121549 **Survey of the Astrographic Catalogue from 1 to 31 degrees of northern declination.** A.Fresneau (Space Telescope Sci. Inst., Baltimore, MD, USA).
Astron. J. (USA), vol.88, no.9, p.1378-81 (Sept. 1983).
5500 astrographic plates, covering nearly a quarter of the sky and providing 1870976 star positions (with a precision corresponding to a standard error of 0.4 arcsec) and photographic magnitudes (with a precision corresponding to a standard error of 0.4 mag) in the AGK 2/3 system, have been combined into a catalogue of 1025208 stars with their mean values of positions and magnitude at the mean epoch of observations (around 1905). This survey is essentially complete up to photographic magnitude 12.7. The integrated star densities in both galactic hemispheres are in good agreement. This survey, with at least 50 stars per square degree in most cases, may still be useful for photographic plate scale calibration. (11 refs.)

121550 **A catalogue of Jovian decametric radio observations from January 1980 to December 1981.** Y.Leblanc, A.Gerbault, M.Rubio, F.Genova (Obs. de Paris, Meudon, France).
Astron. & Astrophys. Suppl. Ser. (France), vol.54, no.1, p.135-48 (Oct. 1983).
The catalogue lists Jupiter's decametric emission recorded by the Nancay Radiospectrograph during the period from January 1980 to December 1981. The events have been recorded in the spectral range of 10-40 MHz, eight hours daily. Diagrams showing the occurrence probability of emission during this period are given. In addition to the well-known high probability of the Io related B and A sources, the Io-A′ source identified by Leblanc (1981) is well defined with a higher occurrence probability than the non Io-controlled sources. (14 refs.)

121551 Catalogue of nonstellar molecular maser sources and their probable infrared counterparts in the galactic plane. M.A.Braz (Inst. Astron. e Geofisico, Univ. de Sao Paulo, Sao Paulo, Brazil), N.Epchtein.
Astron. & Astrophys. Suppl. Ser. (France), vol.54, no.1, p.167-85 (Oct. 1983).
The catalogue contains the positions and characteristics of 288 nonstellar maser sources located in the galactic disk and of 76 infrared objects assumed to be associated with a maser source in view of their proximity and protostellar characteristics. Some new statistical conclusions are drawn. The paper also provides a major reference list and is intended to prepare further statistical works on the distribution of star formation regions in the Galaxy and to help in the identification of IRAS sources. (262 refs.)

121552 Radial velocities of planetary nebulae. S.E.Schneider, Y.Terzian (Nat. Astron. & Ionosphere Center, Cornell Univ., Ithaca, NY, USA), A.Purgathofer, M.Perinotto.
Astrophys. J. Suppl. Ser. (USA), vol.52, no.4, p.399-423 (Aug. 1983).
A catalog of all known radial velocities and their errors for 524 galactic planetary nebulae is presented. One hundred and two sources have been consulted, comprising 920 separate velocity measurements are discussed. The various sources of error in the measurements and techniques for their estimation are explained. New radial velocity measurements for 19 planetary nebulae are included. Some basic statistics of the radial velocities of the planetary nebulae population are also presented. (109 refs.)

121553 Spectral evolution of galaxies. II. An atlas of IUE spectra of late type stars and nearby early type stellar systems. G.Bruzual A. (Centro de Investigacion de Astron., Merida, Venezuela).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.8, no.1, p.29-37 (June 1983).
For pt.I see Astrophys. J., vol.273, no.1, p.105-27 (1983). (15 refs.)

95.90 OTHER TOPICS IN ASTRONOMY AND ASTROPHYSICS

121554 Siblings for SETI. D.Frisch, F.Melia (MIT, Cambridge, MA, USA).
Icarus (USA), vol.55, no.3, pt.1, p.432-8 (Sept. 1983).
Intelligent beings can single out each other as special targets for communication if their stars have common properties, and can thus perhaps be stimulated to broadcast and listen directionally to try to give the coincidence between sending and listening that is necessary. The SAO Catalogue of roughly 260000 stars was culled for such 'sibling' candidates using their spectra, location, and motion. Only a few of the roughly 50000 tabulated G-stars proved interesting, in part because the information about almost all of them is imprecise, and in part perhaps because criteria were overselective. However, a set of mostly untabulated sibling candidate stars can be defined, given a direction and small solid angle that are mutually interesting to members of that set, so that overlapping broadcast/receiving cones can be selected on the basis of this commonality. The double cone about the direction to the galactic center, with half angle $\alpha=e^2/\hbar c=1/137$ radian, is an almost inevitable choice. With current technology, sending as well as receiving within this small solid angle can reach to about 1 kpsc, making available an estimated 10^3 G-star sibling candidates. (9 refs.)

121555 Simulation of Viking biology experiments suggests smectites not palagonites, as Martian soil analogues. A.Banin (Ames Res. Center, NASA, Moffett Field, CA, USA), L.Margulies.
Nature (GB), vol.305, no.5934, p.523-5 (6 Oct. 1983).
The mineralogical composition of the fine soil of Mars has not been determined and remains a controversial subject. During and immediately after the Viking mission, smectite clays were considered as the most likely Mars soil analogue material (MarSAM), but recently it has been suggested that the most likely MarSAM is palagonite, an amorphous weathering product of mafic volcanic glass. The authors present the results of an experimental comparison between palagonites and a smectite (montmorillonite) in a simulation of the Viking Biology Labelled Release (LR) experiment and draw conclusions regarding their suitability as MarSAMs. It was found that palagonites do not cause the formate decomposition and ^{14}C release observed in the LR experiment on Mars, neither in their natural form nor after acidification, and thus cannot be a completely satisfactory analogue to the mars soil studied by Viking. (23 refs.)

Proceedings of the Meeting of the Astronomical Science Group of Ireland .... See Entry 116919

Seeing for the solar observations on the Terskol Peak .... See Entry 121369

96.00 SOLAR SYSTEM

96.10 GENERAL, SOLAR NEBULA, AND COSMOGONY

121556 Collisional processes of planetesimals with a protoplanet under the gravity of the proto-Sun. S.Nishida (Dept. of Industrial & Systems Engng., Setsunan Univ., Osaka, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.93-105 (July 1983).
The author investigates collisional processes of planetesimals with a protoplanet, assuming that the mass of the protoplanet is much larger than that of a planetesimal and the motion of the planetesimal is limited in the two-dimensional ecliptic plane. They describe the orbit by a solution to the plane circular restricted three-body problem. Integrating numerically the equations of motion of the plane circular RTB problem for numerous sets of initial osculating orbital elements, they obtain the overall features of the encounters between the Keplerian particles. They represent only the cases $e=0$ and $4h$, where e is the eccentricity of the planetesimal far from the protoplanet and h is the normalized Hill radius of the protoplanet. They find that the collisional rate of Keplerian particles is enhanced by a factor of about 2.3 ($e=0$) or 1.4 ($e=4h$) compared with that of particles in a free space, as long as they are concerned with the two-dimensional motion of particles. (11 refs.)

The young Sun and the atmosphere and photochemistry of the early Earth .... See Entry 121376

Cumberland Falls chondritic inclusions. II. Trace element contents of forsterite chondrites and meteorites of similar redox state .... See Entry 121629

96.20 MOON

121557 Possible lunar source areas of meteorite ALHA 81005: geochemical remote sensing information. C.M.Pieters (Dept. of Geological Sci., Brown Univ., Providence, RI, USA), B.R.Hawke, M.Gaffey, L.A.McFadden.
Geophys. Res. Lett. (USA), vol.10, no.9, p.813-16 (Sept. 1983).
Antarctic meteorite ALHA 81005 is a regolith breccia apparently sent to Earth by an impact event in the lunar highlands. Laboratory studies of this sample provide information that is used to understand the source region of the Moon using remote sensing data. The meteorites low thorium content is inconsistent with thorium values measured for the central lunar nearside from orbit with Apollo γ-ray spectrometers. Similarly, the mineral assemblages inferred from near infrared spectra of small impact craters on the lunar nearside do not exhibit the significant component of olivine and Fe-bearing feldspar that is observed in the meteorite spectra. The existing remote sensing data suggest the most probable source region for ALHA 81005 is the near-side limb or the lunar farside and that the composition of ALHA 81005 represents a surface unit that has not previously been extensively sampled. (18 refs.)

The secular accelerations in Gylden's problem .... See Entry 121511

A method for the identification and elimination of contamination during carbon isotropic analyses of extraterrestrial samples .... See Entry 121547

The discovery and initial characterization of Allan Hills 81005: the first lunar meteorite .... See Entry 121611

Regolith breccia Allan Hills A81005: evidence of lunar origin, and petrography of pristine and nonpristine clasts .... See Entry 121612

Origin of lunar meteorite ALHA 81005: clues from the presence of terrae clasts and a very low-titanium mare basalt clast .... See Entry 121613

Petrology of ALHA 81005, the first lunar meteorite .... See Entry 121614

ALHA 81005: Moon, Mars, petrography, and Giordano Bruno .... See Entry 121615

Meteorite ALHA 81005: petrology of a new lunar highland sample .... See Entry 121616

Oxygen and silicon isotopes in ALHA 81005 .... See Entry 121617

Trapped noble gases indicate lunar origin for Antarctic meteorite .... See Entry 121618

Recent cosmic ray exposure history of ALHA 81005 .... See Entry 121619

Ferromagnetic resonance and magnetic properties of ALHA 81005 .... See Entry 121620

Thermoluminescence and nuclear particle tracks in ALHA 81005: evidence for a brief transit time .... See Entry 121621

Antarctic meteorite ALHA 81005, a piece from the ancient lunar crust .... See Entry 121622

Siderophile, lithophile and mobile trace elements in the lunar meteorite Allan Hills 81005 .... See Entry 121623

ALHA 81005 meteorite: chemical evidence for lunar highland origin .... See Entry 121624

Antarctic meteorite ALHA 81005—not just another lunar anorthositic norite .. .. See Entry 121625

Compositional implications regarding the lunar origin of the ALHA 81005 meteorite .... See Entry 121626

Composition of bulk samples and a possible pristine clast from Allan Hills A81005 .... See Entry 121627

Al-Sm-Eu-Sr systematics of eucrites and Moon rocks: implications for planetary bulk compositions .... See Entry 121628

96.30 PLANETS AND SATELLITES

(exc. the Moon; for celestial mechanics, see 95.10; for Earth as an astronomical body, see 91. Geophysics)

121558 Intensity and polarization line profiles in a semi-infinite Rayleigh-scattering planetary atmosphere. II. Variations of equivalent width over the disk. R.K.Bhatia, K.D.Abhyankar (Centre of Advanced Study in Astron., Osmania Univ., Hyderabad, India).
J. Astrophys. & Astron. (India), vol.4, no.1, p.27-33 (March 1983). [received: Oct. 1983]
For pt.I see ibid., vol.3, no.3, p.303-24 (1982). The study of the variation of equivalent width in a Rayleigh-scattering planetary atmosphere along the intensity equator and along the mirror meridian on which $\mu=\mu_0$ shows that the equivalent widths decrease monotonically towards the poles, the limb and the terminator with the following characteristics: (i) the weakest lines exhibit the maximum change; (ii) the I_r^e component shows more change than the I_l^e component; (iii) the decrease towards the limb or the terminator is not as sharp as that towards the poles; (iv) I_l^e component shows more decrease towards the limb while I_r^e component shows more decrease towards the terminator; and (v) the relation $W(\mu,\phi;\mu_0,\phi_0)=W(\mu_0,\phi_0;\mu,\phi)$ holds for the total intensity. These results are qualitatively in agreement with the observations of absorption bands in the spectra of Venus, Jupiter and Saturn. (8 refs.)

121559 Intensity and polarization line profiles in a semi-infinite Rayleigh-scattering planetary atmosphere. III. Variation of polarization profiles and the Stokes parameter Q over the disk. R.K.Bhatia, K.D.Abhyankar (Centre of Advanced Study in Astron., Osmania Univ., Hyderabad, India).
J. Astrophys. & Astron. (India), vol.4, no.1, p.35-46 (March 1983). [received: Oct. 1983]
For pt.II see ibid., vol.4, no.1, p.27-33 (1983). The variation of the polarization profiles, the Stokes parameters Q and U, and the angle defining the plane of polarization along the intensity equator and along the mirror meridian, on which $\mu=\mu_0$, in a Rayleigh-scattering atmosphere is studied. It is found that these variations are more complex than thought hitherto, particularly at large phase angles. (7 refs.)

121560 Impact experiments on ice. S.Kawakami, H.Mizutani, Y.Tagai, M.Kato, M.Kumazawa (Dept. of Earth Sci., Nagoya Univ., Nagoya, Japan).
J. Geophys. Res. (USA), vol.88, no.B7, p.5806-14 (10 July 1983).
The results of cratering and fragmentation experiments on pure ice are reported. The projectiles used are cylindrical aluminum, poly-carbonate, Teflon, and pyrophyllite fired at velocities between 110 m/sec and 680 m/sec, with kinetic energies at impact between 2 and 500 joules. Crater depths and diameters were studied and comparisons with craters in basalt were made. The specific energy for complete destruction of ice target is about 50 J/Kg. The present experiments show that the impacts associated with the largest craters on Callisto and Mimas must have severally fractured the whole satel-

lites, and that those giant impacts with the kinetic energy of 10^{23} to 10^{27} joules probably affected significantly the evolution of the satellites. (33 refs.)

Efficient methods to calculate Chandrasekhar's *H*-functions . See Entry 121543

Collisional processes of planetesimals with a protoplanet under the gravity of the proto-Sun ....See Entry 121556

Al-Sm-Eu-Sr systematics of eucrites and Moon rocks: implications for planetary bulk compositions .... See Entry 121628

96.30D Mercury

The Sun's quadrupole moment and perihelion precession of Mercury ....See Entry 121526

96.30E Venus

121561 Photographic positional observations of Venus at the main astronomical observatory of the Ukrainian Academy of Sciences during 1975. A.B.Onegina, E.M.Sereda.
Astrometriya & Astrofiz. (USSR), no.49, p.13-17 (1983). In Russian.
35 positions of Venus are given in the reference stellar system of the Catalogue of the Smithsonian Astrophysical Observatory and that of AGK3. The plates were obtained with the 400 mm astrograph (F=5.5 m) during 1975. The positions of Venus are given with corrections for atmospheric dispersion and for the phase of the planet. (2 refs.)

121562 Evaluating aerosol concentration in the upper cloud layer of Venus. N.V.Goroshkova, E.V.Petrova.
Cosmic Res. (USA), vol.21, no.1, p.91-5 (Jan.-Feb. 1983). Translation of: *Kosm. Issled. (USSR)*, vol.21, no.1, p.106-10 (Jan.-Feb. 1983). [received: Sept. 1983]
An improved calculation is given for the spectral variation of the extinction coefficient for an aerosol medium of a 75% solution of H_2SO_4 in the range from 200-1400 cm^{-1}. Sulfuric acid bands have been obtained which have been identified in the Venus spectrum. The concentration of particles in the upper layer of clouds has been found, and the results are compared with radiometric experiment data on the Venera 9 and 10 spacecraft, and the experiment carried out with Pioneer-Venus experiment. (14 refs.)

121563 Nonthermal escape of hydrogen and deuterium from Venus and implications for loss of water. S.Kumar (Center for Space Sci., Univ. of Southern California, Los Angeles, CA, USA), D.M.Hunten, J.B.Pollack.
Icarus (USA), vol.55, no.3, pt.1, p.369-89 (Sept. 1983).
Nonthermal escape processes responsible for the escape of hydrogen and deuterium from Venus are examined for present and past atmospheres. Three mechanisms are important for the escape of hydrogen from the present atmosphere: (a) charge exchange of plasmaspheric H^+ with exospheric H, (b) impact of exospheric hot O atoms on H, and (c) ion molecule reactions involving O^+ and H_2. However, in the past when the H abundance was higher, the charge-exchange mechanism would be the strongest. The H and D escape fluxes are discussed with the H_2O mixing ratio. The onset of hydrodynamic flow leading to efficient H escape occurs just at the H_2O mixing ratio at which the charge-exchange escape flux saturates. Thus it is possible that Venus has lost an Earth-equivalent ocean of water over geologic time. (60 refs.)

121564 Venus: identification of banded terrain in the mountains of Ishtar Terra. D.B.Campbell (Nat. Astron. & Ionospheric Center, Arecibo Obs., Arecibo, Puerto Rico), J.W.Head, J.K.Harmon, A.A.Hine.
Science (USA), vol.221, no.4611, p.644-7 (12 Aug. 1983).
High resolution images obtained with the Arecibo radar system at a wavelength of 12.6 centimeters reveal numerous parallel 10 to 20-kilometer-wide bands of high radar backscatter situated on and oriented parallel to the major mountain ranges of the Ishtar Terra region of Venus. Geometric and morphological characteristics suggest that the bands represent Earth-like tectonic deformational features, such as folds and faults. (22 refs.)

Observations of the 10-μm natural laser emission from the mesospheres of Mars and Venus ....See Entry 121566

Modeling of the 10-μm natural laser emission from the mesospheres of Mars and Venus ....See Entry 121567

96.30G Mars

121565 Nature of the magnetic fields near Mars. E.M.Dubinin, P.L.Izrailevich, I.M.Podgornyi, S.I.Shkol'nikova.
Cosmic Res. (USA), vol.21, no.1, p.95-9 (Jan.-Feb. 1983). Translation of: *Kosm. Issled. (USSR)*, vol.21, no.1, p.111-15 (Jan.-Feb. 1983). [received: Sept. 1983]
An analysis of magnetic field measurements from the spacecraft Mars 3 and Mars 5, which were made in a rotating coordinate system with axis defined by the direction of the interplanetary magnetic field, has shown that there is a region near Mars in which there is no correlation between the direction of the measured magnetic field and that of the transverse component of the interplanetary magnetic field. The field in this region is the intrinsic field of Mars. The distribution of the magnetic field vectors between this region and the shock wave is in agreement. with a blanketing model. (18 refs.)

121566 Observations of the 10-μm natural laser emission from the mesospheres of Mars and Venus. D.Deming, F.Espenak, D.Jennings, T.Kostiuk, M.J.Mumma (NASA/Goddard Space Flight Center, Greenbelt, MD, USA), D.Zipoy.
Icarus (USA), vol.55, no.3, pt.1, p.347-55 (Sept. 1983).
Nonthermal emission occurs in the cores of the 9.4- and 10.4-μm CO_2 bands on Mars, and has been identified as a natural atmospheric laser. This paper presents observations of the total flux and center-to-limb dependence of this emission for Mars and Venus. The emission is believed to be excited by absorption of solar flux in the near-IR CO_2 bands, followed by collisional transfer to the 00°1 state of CO_2. A comparison is made between the observations and a detailed theoretical model based on this mechanism. The emission is used to obtain the kinetic temperatures of the Martian and Venusian mesospheres. (21 refs.)

121567 Modeling of the 10-μm natural laser emission from the mesospheres of Mars and Venus. D.Deming, M.J.Mumma (NASA/Goddard Space Flight Center, Greenbelt, MD, USA).
Icarus (USA), vol.55, no.3, pt.1, p.356-68 (Sept. 1983).
Nonthermal emission which occurs in the cores of the 9.4- and 10.4-μm CO_2 bands on Mars has been identified as a natural atmospheric laser. The emission is believed to be excited by absorption of near-IR solar flux, followed by collisional transfer to the 00°1 state of CO_2. A numerical model based on this mechanism is developed which includes the solar pumping contributed by $\sim 2\times 10^4$ near-IR CO_2 lines. The non-Local Thermodynamic Equilibrium radiative transfer problem is solved to obtain the 00°1 vibrational state population. This model successfully reproduces the existing center-to-limb observations, although higher spatial resolution observations are needed for a definitive test. (25 refs.)

121568 Speculation on Martian north polar wind circulation and the resultant orientations of polar sand dunes. A.W.Ward, K.B.Doyle (US Geological Survey, Flagstaff, AZ, USA).
Icarus (USA), vol.55, no.3, pt.1, p.420-31 (Sept. 1983).
Dunes in the Martian north polar erg show two dominant orientations. When seen at frost cap minimum, dunes north of 80°N record east winds, dunes south of 80°N record west winds. Many of the transverse dunes are considered to be reversing dunes. Dunes in two fields may have reversed at least once during the lifetime of the Viking Orbiters. Poor agreement exists among published predictive models of north polar winds and the interpretations derived from the major published map of the north polar dunes. The authors propose that the average polar winds are: (1) strong, off-pole northwest winds in fall; (2) moderate west winds in winter; (3) latitude-dependent weak to strong off-pole northeast winds in spring; and (4) weak west winds in summer. (19 refs.)

121569 Laboratory exercises in astronomy—the orbit of Mars. O.Gingerich (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Sky & Telesc. (USA), vol.66, no.4, p.300-2 (Oct. 1983).
Discusses a procedure to determine the orbit and apparent motion of Mars. The scheme was originally presented by Kepler and a brief historical note is presented. (no refs.)

Temperature dependence of the carbon dioxide photoabsorption cross section between 1200 and 1970 Å ....See Entry 120655

Simulation of Viking biology experiments suggests smectites not palagonites, as Martian soil analogues .... See Entry 121555

Martian gases in an Antarctic meteorite? .... See Entry 121637

96.30H Asteroids

121570 The Tunguska event: no cometary signature in evidence. Z.Sekanina (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Astron. J. (USA), vol.88, no.9, p.1382-14 (Sept. 1983).
It is argued that existing information on the 1908 Tunguska fall rules out the possibility that the object was a comet fragment, active or extinct. Evidence on the fireball's enormous terminal explosion several kilometers above the Earth is indicative of the apparent absence of a major breakup in flight before the almost instantaneous mass dissipation of $\sim 10^{12}$g and invites comparison with a number of the Prairie Network and European Network fireballs displaying prominent terminal flares. It is shown that a fireball of the Tunguska mass is not decelerated very efficiently by the Earth's atmosphere regardless of the assumed ablation rate. As a result, at an entry velocity of $\sim$30 km/s the fireball would have resisted aerodynamic pressures in excess of 10^9 dyn/cm^2 before disintegrating. It is inconceivable that cometary material known for its extreme fragility could survive a load of this magnitude. The data on the Type II fireballs with prominent terminal flares are extrapolated to estimate Tunguska's critical dynamic pressure at the explosion to be some 2×10^8 dyn/cm^2 and to infer that the fireball's pre-explosion velocity amounted to $\sim$10 km/s, ruling out a comet-like orbit. In order for the Tunguska object to penetrate deep into the atmosphere, high ablation rates that are characteristic of cometary fireballs should require that Tunguska's initial mass be orders of magnitude greater than indicated by evidence. Its association with a short-period comet of Jupiter's family, including P/Encke, is furthermore contradicted by much too large an angle that Tunguska's line of apsides would then make with Jupiter's orbit plane. The Tunguska object is described most consistently as a small Apollo-type asteroid, 90-190 m across, having orbited the Sun between $\lesssim 1$ and 1.5 Au before it struck the Earth. The object's common origin with the Farmington meteorite is considered but found to be highly unlikely. (86 refs.)

121571 308 astrometric positions of minor planets—in February and March 1981, ESO, La Silla, Chile. H.Debehogne (Obs. Royal de Belgique, Brussels, Belgium), L.E.Machado, J.F.Caldeira, E.R.Netto, G.G.Vieira.
Acta Astron. (Poland), vol.33, no.1, p.171-81 (1983).
308 astronomical positions and dependences of asteroids are given as obtained from photographic observations made at the GPO (D=40 cm; f=4 m)-ESO, La Silla, Chile, during February and March 1981. The reductions of the observations were obtained by means of five reference stars (RAO Catalogue) through two methods: dependences and least squares. (no refs.)

121572 381 astrometric positions of minor planets obtained at the GPO telescope of ESO, La Silla, February/March, 1981. H.Debehogne (Obs. Royal de Belgique, Brussels, Belgium), L.E.Machado, J.F.Caldeira, G.G.Vieira, E.R.Netto, A.Le Van Suu.
Astron. & Astrophys. Suppl. Ser. (France), vol.54, no.1, p.47-53 (Oct. 1983).
381 astrometric positions of minor planets observed at the European Southern Observatory during February/March, 1981 are given. The plates were measured on the Ascorecord measuring machine of the Observatorio do Valongo. The positions were computed by means of dependences and of least squares. The SAO Star Catalogue was used for positions and proper motions of the comparison (basis) stars at the equinox 1950.0. (4 refs.)

121573 Positions of asteroids obtained with the CERGA Schmidt telescope. G.Hahn (Astron. Obs., Uppsala, Sweden), J.-L.Heudier, C.-I.Lagerkvist.
Astron. & Astrophys. Suppl. Ser. (France), vol.54, no.1, p.191-2 (Oct. 1983).
50 positions of numbered asteroids and 82 positions of unnumbered asteroids obtained during January and February 1982 with the CERGA Schmidt telescope are presented. (2 refs.)

121574 Asteroids and meteorites: parent bodies and delivered samples. R.Greenberg, C.R.Chapman (Planetary Sci. Inst., Tucson, AZ, USA).
Icarus (USA), vol.55, no.3, pt.1, p.455-81 (Sept. 1983).
Meteorites may be derived mainly by cratering rather than by disruptive fragmentation and from large main-belt asteroids rather than from small, Earth-approaching bodies. The model combines a wide variety of evidence from various disciplines to yield results consistent with meteorite statistics. However, no claim is made for uniqueness of this model, and many elements still admit considerable uncertainty. (43 refs.)

121575 A mechanism of formation for the Kirkwood gaps. J.Henrard, A.Lemaitre (Dept. of Maths., Facultes Univ. de Namur, Namur, Belgium).
Icarus (USA), vol.55, no.3, pt.1, p.482-94 (Sept. 1983).
An analytical model describing the effect of a displacement of the Jovian resonances in the asteroid belt is analyzed. It is found that a small displacement can transform a truncated uniform density distribution of asteroids into a gap. As a possible explanation for the displacement, the effect of the removal of an accretion disk in the early stage of the solar system is investigated. It is found that removal of a disk containing a few percent of the solar

mass between the orbit of the asteroids and the orbit of Jupiter is sufficient to account for the observed Hecuba gap. (22 refs.)

121576 The rotation, color, phase coefficient, and diameter of 1915 Quetzalcoatl. R.P.Binzel (Dept. of Astron., Univ. of Texas, Austin, TX, USA), D.J.Tholen.
Icarus (USA), vol.55, no.3, pt.1, p.495-7 (Sept. 1983).
Photoelectric observations of 1915 Quetzalcoatl on March 2, 1981 show that this asteroid has a rotational period of 4.9 ± 0.3 hr and a lightcurve amplitude of 0.26 magnitudes. B-V and U-B colors are found to be 0.83 ± 0.04 and 0.43 ± 0.03, respectively, consistent with Quetzalcoatl being an *S*-type asteroid. Additional observations from March 31, 1981 give a linear phase coefficient of 0.033 mag deg^{-1} and a mean $B(1,0)$ magnitude of 20.10. The resulting estimated mean diameter for Quetzalcoatl is only 0.37 km, making it one of the smallest asteroids for which physical observations have yet been made. (9 refs.)

121577 1983 SA. P.Wild.
I.A.U. Circ. (USA), no.3871, 1 pp. (30 Sept. 1983).
Reports the discovery of a fast-moving asteroidal object in Pegasus. Two precise positions are reported for the period 1983 September 26 to 28. (no refs.)

121578 1983 RD. A.W.Harris.
I.A.U. Circ. (USA), no.3871, 1 pp. (30 Sept. 1983).
It is reported that the rotation period of this Amor-type asteroid was still ambiguous (i.e. 4.90 or 2.45 hours) after photometric observations on 1983 September 15. The peak-to-peak amplitude at this time was found to be >0.10 mag. (1 ref.)

121579 1983 SA. P.Wild, B.G.Marsden.
I.A.U. Circ. (USA), no.3875, 1 pp. (5 Oct. 1983).
Three precise positions, covering the period 1983 October 1 to 3, are reported for this fast-moving asteroidal object. Orbital elements are given, together with an ephemeris for the period 1983 September 3 to November 2 at five-day intervals; the orbit is found to be cometary rather than asteroidal. (no refs.)

121580 1983 SA. E.Bowell, B.G.Marsden.
I.A.U. Circ. (USA), no.3877, 1 pp. (7 Oct. 1983).
Precise positions of this fast-moving asteroidal object are reported for the epochs 1983 September 10 and October 4, together with improved orbital elements. (no refs.)

121581 Minor Planet Circulars 8085-8/82.
Minor Planet Circ. (USA), no.8085-8182, 98 pp. (22 Sept. 1983).
Present precise positions for asteroids and 23 comets observed at 22 observatories or observing stations. Indentification changes are given for three asteroids and eight objects are identified with numbered minor planets. Orbital elements are given for seven comets, 127 one-opposition asteroids, newly-numbered asteroids 2910-2927, and one named object (993 MOULTONA) as well as 25 asteroids still with just discovery designations including two Palomar-Leiden objects. Ephemerides are given for seven comets and 78 minor planets for the inclusive period 1983 September 23-1985 April 5 at 10-day intervals. Finally new names are given to 26 sasteroids.

121582 363 precise positions of asteroids. H.Debehogne (Obs. Royal de Belgique, Brussels, Belgium), L.E.Machado, J.F.Caldeira, E.R.Netto, G.G.Vieira.
Rev. Mex. Astron. & Astrofis. (Mexico), vol.8, no.1, p.19-27 (June 1983).
363 astronomical positions and dependences of asteroids are given as obtained from photographic observations made at the GPO (D=40 cm; f=4 m)-ESO, La Silla, Chile, during February and March 1981. The reductions of the observations are obtained by means of five reference stars (SAO Catalogue) through two methods: dependences and least squares. Of the 363 positions, 206 correspond to 5 new asteroids. (3 refs.)

Perturbation in the Comet's motion caused by Ceres, Pallas and Vesta ....See Entry 121595

Comet Kowal-Vavrova (1983t) ....See Entry 121605

96.30K Jupiter

121583 A finite-volume, adaptive grid algorithm applied to planetary entry flowfields. P.A.Gnoffo (NASA Langley Res. Center, Hampton, VA, USA).
AIAA J. (USA), vol.21, no.9, p.1249-54 (Sept. 1983).
An adaptive grid, finite volume method has been applied to problems of planetary entry in computing complete flowfields. The adaptation algorithm is implicit in nature and is keyed to resolve user-specified gradients. The finite-volume algorithm is explicit, utilizing a maximum time step advancement at each grid point to accelerate convergence to the steady state. The present version of the code is for the laminar flow of a perfect gas. The role of the adaptation algorithm in resolving various features of blunt body/wake flow for planetary entry conditions is emphasized. The algorithm is demonstrated on problems involving massive blowing from the surface of the Galileo probe and moderate blowing from the surface of a sphere. (16 refs.)

121584 A new type of decameter sporadic radiation from Jupiter. B.P.Ryabov, V.A.Shevchenko.
Astrometriya & Astrofiz. (USSR), no.49, p.27-31 (1983). In Russian.
Presents results of observations of Jupiter obtained in the 10-17.5 MHz range. Measurements were made with a 30-channel parallel spectrum analyzer providing frequency resolution of 250 kHz and time resolution of 3 ms. A new type of decameter radiation—a succession of single wide-band pulses of 10-100 ms in duration—was found along with the well-known type L and type S radio bursts. The pulses show no frequency drift and resemble the VLF signals from lightning discharges which were recorded during the Voyager-1 mission. (7 refs.)

121585 Inertia coefficient considerations and the structure of Jovian planets. C.Denis (Dept. of Phys., Middle East Tech. Univ., Ankara, Turkey).
Celestial Mech. (Netherlands), vol.31, no.1, p.81-94 (Sept. 1983).
For Jupiter, an overall density model of the form $\rho=\rho_0(1-x^n)$, with $n \approx {}^1/_3$ and $\rho_0/\bar{\rho} \approx 10$, is consistent with information presently at hand; for Saturn, however, such a density law would lead to unacceptably high densities in the vicinity of the centre. The limiting cases of the previous law are shown to be $n=+\infty$, corresponding to a homogeneous sphere, and $n=-3$, corresponding to a particular central particle model, investigated by a number of astronomers over the last hundred years. For $n \leq 0$, the central density becomes $+\infty$. Another possible representation, valid both for Jupiter and Saturn, is the density law $\rho=\rho_0(1-x)^m$, with $m \approx {}^7/_6$, $\rho_0/\bar{\rho} \approx 4.7$ in the case of Jupiter, and $m \approx {}^5/_3$, $\rho_0/\bar{\rho} \approx 7.5$ in the case of Saturn. Graber's (1977) density law based on a maximum entropy principle leads to unacceptably high surface densities, both for Jupiter and Saturn. The author investigates the problems involved in fitting two-layered parametrically simple density laws to theoretically derived much more elaborate models of the Jovian planets. (13 refs.)

121586 The Jovian spectrum in the 3-μm window. P.Drossart, T.Encrenaz (Obs. de Meudon, Meudon, France).
Icarus (USA), vol.55, no.3, pt.1, p.390-8 (Sept. 1983).
The spectral window of Jupiter at 3 μm is analyzed and compared with previous published spectra. The two components of the spectrum, the thermal and the solar reflected contributions, are calculated at low resolution (30 cm^{-1}) between 3300 and 3800 cm^{-1} for preparing the interpretation of the Galileo Near Infrared Mapping Spectrometer experiment. (29 refs.)

121587 Formation and photochemistry of methylamine in Jupiter's atmosphere. J.A.Kaye, D.F.Strobel (Naval Res. Lab., Washington, DC, USA).
Icarus (USA), vol.55, no.3, pt.1, p.399-419 (Sept. 1983).
The formation of methylamine (CH_3NH_2) in the upper troposphere and lower stratosphere of Jupiter is investigated. Translationally hot hydrogen atoms are produced in the photolysis of ammonia, phosphine, and acetylene which react with methane to produce methyl (CH_3) radicals; the latter recombine with NH_2 to form CH_3NH_2. Also, methane is catalytically dissociated to CH_3+H by the species C_2 and C_2H produced in the photolysis of acetylene. It is shown that the combined production of CH_3NH_2 and subsequent photolysis to HCN is unlikely to account for the HCN observed near Jupiter's tropopause. Recombination of NH_2 and C_2H_3 radicals to yield C_2H_5N followed by photolysis to HCN is the preferred path. Production of C_2H_6 by these two processes is negligible in comparison to the downward flux of C_2H_6 from the Lyman α photolysis region of CH_4. An upper limit column density on CH_3PH_2 is estimated to be $\sim 10^{13}$ cm^{-2} as compared to 10^{15} cm^{-2} for CH_3NH_2. Hot H atoms account for a negligible fraction of total ortho-para conversion by the reaction $H+H_2$. (65 refs.)

121588 Satellites of Jupiter and Saturn. R.M.West.
I.A.U. Circ. (USA), no.3872, 1 pp. (30 Sept. 1983).
Names and permanent designations are given for recently discovered satellites of Jupiter and Saturn. (1 ref.)

121589 Charged particle distributions in Jupiter's magnetosphere. N.Divine, H.B.Garrett (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.6889-903 (1 Sept. 1983).
A compact, quantitative model of the distribution of charged particles between 1 eV and several MeV in the Jovian magnetosphere is presented. The model is based primarily on in situ data returned by experiments on the Pioneer and Voyager spacecraft, supplemented where necessary by Earth-based observations and theoretical considerations. Thermal plasma parameters, notably convection speed, number density, and characteristic energy, are specified as functions of position for electrons and several ion species (H^+, O^+, O^{++}, S^+ S^{++}, S^{+++}, and Na^+). At intermediate energy the electron and proton populations are modeled using kappa distributions, which join smoothly onto the radiation belt spectra at high energies ($E>100$ keV). Major features of the magnetic field, thermal plasma, and trapped particle distributions are modeled, such as a ring and satellite absorption signatures and corotational flow within the Io plasma torus and the current disk. (69 refs.)

121590 Global multispectral mosaics of the icy Galilean satellites. T.V.Johnson (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA), L.A.Soderblom, J.A.Mosher, G.E.Danielson, A.F.Cook, P.Kupferman.
J. Geophys. Res. (USA), vol.88, no.B7, p.5789-805 (10 July 1983).
Multispectral mosaics of the three icy Galilean satellites have been produced from low- to moderate-resolution Voyager images. The digital image data have been reduced to normal albedos for four-color band passes, centered at 0.35, 0.41, 0.48 and 0.59 μm. Cylindrical map projection at a uniform scale of 8 km per pixel was used. Preliminary analysis of the normal abedo data shows that (1) the darkest terrains on the satellites are the dark regions on Callisto, (2) the brightest regions are bright plains regions on Europa and bright, fresh craters on Ganymede, (3) bright craters on Ganymede and its dark, cratered regions are both significantly brighter than comparable terrains on Callisto, and (4) Europa exhibits several distinct spectral units. (46 refs.)

Introduction to two-dimensional turbulence ....See Entry 118562

Nonequilibrium radiative heating of an ablating Jovian entry probe ....See Entry 121496

A catalogue of Jovian decametric radio observations from January 1980 to December 1981 ....See Entry 121550

Impact experiments on ice ....See Entry 121560

Radio emission signature of Saturn immersions in Jupiter's magnetic tail ....See Entry 121592

96.30M Saturn

121591 Some consequences of meteoroid impacts on Saturn's rings. G.E.Morfill (Max-Planck-Inst. fur Extraterrestrische Phys., Garching, Germany), H.Fechtig, E.Grun, C.K.Goertz.
Icarus (USA), vol.55, no.3, pt.1, p.439-47 (Sept. 1983).
High-velocity impacts of interplanetary meteoroids on Saturn's rings are discussed. It is shown that the neutral gas emitted by impact vaporization may be responsible, to a large part, for the observed neutral ring atmosphere. Both the predicted neutral gas injection rate and the gas temperature (or kinetic energy) are compatible with measurements. Heavy ejecta particles produce a particulate ring 'halo'. The physical properties of this halo are calculated, and it appears to be identical with the tenuous particle population discussed by Baum and Kreidl (1982). Erosion of Saturn's ring particles, the resulting mass balance, and regolith formation are estimated. This provides some constraints on surface properties and optical albedo. (34 refs.)

121592 Radio emission signature of Saturn immersions in Jupiter's magnetic tail. M.D.Desch (Lab. for Extraterrestrial Phys., NASA Goddard Space Flight Center, Greenbelt, MD, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.6904-10 (1 Sept. 1983).
During the interval from about May through August 1981, when Voyager 2 was inbound to Saturn, the planetary radio astronomy instrument measured repeated, dramatic decreases in the intensity of the Saturn kilometric radiation (SKR). The emission dropouts averaged two orders of magnitude below mean energy levels and varied from about 1 to 10 Saturn rotations in duration. Comparison with pre-Saturn encounter Voyager 1 observations shows that the SKR dropouts were unique to the Voyager 2 observing interval, consistent with the closer proximity of Saturn to Jupiter's distant magnetotail in 1981. Further, the dropouts occurred on the average at times when Voyager 2 is known to have been within or near Jupiter's magnetic tail. Interpretation of these events as the radio signatures of successive Saturn immersions into Jupiter's tail or wake region is consistent with the independent evidence that the SKR radio source is driven externally by the solar wind ram pressure. (15 refs.)

121593 Absorption of energetic protons by Saturn's Ring G. J.A.van Allen (Dept. of Phys. & Astron., Univ. of Iowa, Iowa City, IA, USA).
J. Geophys. Res. (USA), vol.88, no.A9, p.6911-18 (1 Sept. 1983).
A restudy has been made of Pioneer 11 data on the distribution of energetic protons $E_p>80$ MeV in Saturn's inner magnetosphere. An improved value of the ratio of the cosmic ray albedo neutron decay source strength \$ to the radial diffusion coefficient D is 6.9×10^{-24} cm^{-5} at $r\simeq2.67$ R_s (1 R_s=Saturn's equatorial radius). Using the recently calculated lower limit of \$ by Blake et al., one finds an upper limit on the mean residence time T against diffusion of 4.6×10^8 s (15 years) in the major peak of the distribution, whereas using the author's ealier estimate of \$, one finds $T\sim2.2\times10^8$ s (8.0 years). A generous upper limit on D is 2×10^{-10} R_s^2 s^{-1} as found from study of the slot region associated with the co-orbiting satellites 1979 S2 (1980 S3) and 1980 S1. The mean lifetime τ of energetic protons against absorption by particulate matter in Ring G is $<1.1\times10^8$ s (3.5 years) and $\sim5.1\times10^7$ s (1.6 years) corresponding to the two choices of \$. The particulates in Ring G have an effective radius $R\geq0.035$ cm, an areal mass density $\sigma>1.4\times10^{-6}$ g cm^{-2}, and areal number density $n<8\times10^{-3}$ cm^{-2}. It is unlikely that R exceeds 0.1 cm. The radius of Ring G is calculated. (23 refs.)

Impact experiments on ice .... See Entry 121560

Inertia coefficient considerations and the structure of Jovian planets .... See Entry 121585

Satellites of Jupiter and Saturn .... See Entry 121588

96.50 OTHER OBJECTS IN THE PLANETARY SYSTEM

96.50D Interplanetary matter, magnetic and electric fields

(inc. gegenschein and zodiacal light; see also 94.60 Interplanetary space)

121594 Optical properties of interplanetary dust: comparison with light scattering by larger meteoritic and terrestrial grains. K.Weiss-Wrana (Bereich Extraterrestrische Phys., Ruhr-Univ. Bochum, Bochum, Germany).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.240-50 (Oct. 1983).
Recent knowledge about interplanetary dust particles suggests that the main contribution of the zodiacal light is produced by particles between 10 to 100 μm in size. To investigate the scattering characteristics of single particles in this size range systematically, a light scattering instrument was built using electrostatic levitation of single particles. The measured particles consist of terrestrial as well as meteoritic material. Laboratory results demonstrate that the scattering properties of irregularly shaped dark opaque particles with very rough surface and of fluffy dark opaque particles resemble the characteristic features of the empirical scattering function as derived from measurements of the zodiacal light. (65 refs.)

A method for the identification and elimination of contamination during carbon isotropic analyses of extraterrestrial samples .... See Entry 121547

Nature of the magnetic fields near Mars .... See Entry 121565

Helium atoms in the interstellar and interplanetary medium. I. Observations of scattered ultraviolet emission in H I (1216 Å) and H I (584 Å) lines from the Prognoz-5 and Prognoz-6 satellites .... See Entry 121754

96.50G Comets

121595 Perturbation in the Comet's motion caused by Ceres, Pallas and Vesta. B.Todorovic-Juchniewicz (Space Res. Center, Acad. of Sci., Warsaw, Poland).
Acta Astron. (Poland), vol.33, no.1, p.113-17 (1983).
Contains the findings of the magnitude of the perturbations on comets due to the minor planets. The perturbations which are caused by the the three largest minor planets in the heliocentric rectangular coordinates, the mean anomaly, the right ascension and the declination are calculated for fifty periodic comets and three parabolic comets. The minimum distances of a comet from the minor planets after every perihelion and aphelion are obtained. The results clearly indicate that the magnitude of the disturbances is connected with the 'depth' of an approach of a comet to the minor planet, with the time of the mutual influence and with the number of these approaches. (2 refs.)

121596 Improved orbits of three periodic comets: Reinmuth 1, Slaughter-Burnham and Kearns-Kwee. B.Todorovic-Juchniewicz (Space Res. Center, Polish Acad. of Sci., Warsaw, Poland).
Acta Astron. (Poland), vol.33, no.1, p.119-26 (1983).
Observations during five apparitions of Comet Reinmuth 1, three apparitions of Comet Slaughter-Burnham and three of Comet Kearns-Kwee are collected and the orbits of the comets are improved. The following numbers of observations were used when improving the orbits: 59 of Comet Reinmuth 1, 29 of Comet Slaughter-Burnham and 184 of Comet Kearns-Kwee. Nongravitational effects are found in the motion of Comets Reinmuth 1 and Kearns-Kwee. (9 refs.)

121597 Determination of nongravitational parameters for some periodic comets. G.Forti (Osservatorio Astrofisico di Arcetri, Firenze, Italy).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.307-10 (Oct. 1983).
Nongravitational parameters have been redetermined for the periodic comets Schwassmann-Wachmann 2 and Comas Sola. The new results agree with earlier values. New nongravitational constants are computed for comets Ashbrook-Jackson and Kearns-Kwee. For both comets the orbit for the next return is computed taking into account the nongravitational forces. (4 refs.)

121598 On the first transit of nearly parabolic comets across the inner part of the Solar System. Yu.G.Bebenko.
Astrometriya & Astrofiz. (USSR), no.49, p.18-22 (1983). In Russian.
Discusses the first transit of nearly parabolic comets across the inner part of the Solar System as well as the comet number distribution depending on the reciprocals of the major semiaxes. The comet excess in the range of $(50\text{-}100)\times10^{-6}(\mathrm{AU})^{-1}$ is discussed. (13 refs.)

121599 The interaction of comets with solar radiation and the solar wind. I. D.A.Mendis, H.L.F.Houpis (Dept. of Electrical Engng. & Computer Sci., Univ. of California, San Diego, CA, USA).
Int. Comet Q. (USA), vol.5, no.3, p.51-9 (July 1983).
Spectrophotometry of comet atmospheres and tails is discussed. A list is given of spectral identifications in comets. Atmosphere abundances and production rates are discussed. Models are considered. (no refs.)

121600 Recent visual observations of nuclear outbursts in P/Kopff 1982k. J.E.Bortle.
Int. Comet Q. (USA), vol.5, no.3, p.59-60 (July 1983).
At the initiation of each outburst, a bright completely stellar nucleus appears. Within a few days, this feature, while remaining very dense in appearance, becomes non-stellar and progressively spreads across the coma. As it does so, the area of greatest condensation grows slowly weaker, dropping several units in degree of condensation. A minute stellar or near-stellar nucleus does seem to persist throughout each of the outbursts. The author discusses several observations during the period April 18 to July 11 1982. (no refs.)

121601 The light curve of Periodic Comet d'Arrest 1982e. J.E.Bortle.
Int. Comet Q. (USA), vol.5, no.3, p.61-3 (July 1983).
Photometry and visual appearances throughout 1982 are discussed. Magnitude formulae are also considered. (2 refs.)

121602 Tabulation of comet observations.
Int. Comet Q. (USA), vol.5, no.3, p.64-80 (July 1983).
Presents observations of Comet Kohler (1977 XIV), Comet Meier (1978 XXI), Comet Bradfield (1979 X), Comet Meier (1980 XII), Comet Panther (1981 II), comet Austin (1982g), Comet IRAS-Araki-Alcock (1983d), Comet Sugano-Saigusa-Fujikawa (1983e), Comet Cernis (1983l), Periodic Comet Pons-Winnecke (1983b), Periodic Comet Tempel 1 (1982j), Periodic Comet Tempel 2 (1982d), Periodic Comet d'Arrest (1982e), Periodic Comet Kopff (1982k), Periodic Comet Johnson (1983h), Periodic Comet Churyumov-Gerasimenko (1982f), Periodic Comet Gunn, Periodic Comet Russell 3 (1983i), and Periodic Comet Schwassman-Wachmann 1 and Periodic Comet Stephan-Oterma (1980 X). (no refs.)

121603 Modern view on Laplace's problem. H.Hurnik, R.A.Serafin (Astron. Obs., A. Mickiewicz Univ., Poznan, Poland).
Celestial Mech. (Netherlands), vol.31, no.1, p.53-72 (Sept. 1983).
Considers the Laplace's problem pertaining to occurrence probability of elliptical and hyperbolical orbits of comets, assuming various distributions of their velocities and variable initial conditions. Such approach seems to explain contradictory results obtained by different investigators and suggests that predominance of one type over the other type orbits, may result part from assumed maximal velocity range of comets and their velocity distribution. (25 refs.)

121604 Cometary impacts with the Sun: physical and dynamical considerations. P.R.Weissman (Earth & Space Sci. Div., Jet Propulsion Lab., Pasadena, CA, USA).
Icarus (USA), vol.55, no.3, pt.1, p.448-54 (Sept. 1983).
Michels et al. (1982) observed a comet which appears to have impacted the Sun. Sekanina (1982) showed that the comet, 1979 XI, was probably a member of the Kreutz group of Sun-grazing comets. The Sun-grazers typically have perihelia of 1.2-1.9 solar radii but Sekanina found $q=0.35$ $R_\odot$ for 1979 XI. It is interesting to speculate how the perihelion may have been reduced to this small value. The change in perihelion can not be explained by planetary, stellar, or nongravitational perturbations. Tidal splitting of the nucleus on a previous perihelion passage is also ruled out, though a random splitting event near aphelion of the comet's orbit is a remote possibility. The most plausible explanation is collision with another body, most likely a comet, at large heliocentric distance. Another aspect of the problem is whether the nucleus of 1979 XI sublimated completely before impacting the Sun. (23 refs.)

121605 Comet Kowal-Vavrova (1983t). B.G.Marsden, Z.Vavrova.
I.A.U. Circ. (USA), no.3871, 1 pp. (30 Sept. 1983).
It is reported that the new comet announced on IAUC 3868 appears to be identical with the object discovered by Z. Vavrova and listed on MPC 8008 under the designation 1983 JG. Two precise positions measured by Vavrova on 1983 May 14 are reported. (2 refs.)

121606 Comet IRAS (1983o). P.M.Kilmartin, B.G.Marsden.
I.A.U. Circ. (USA), no.3873, 1 pp. (4 Oct. 1983).
Two precise positions are reported for the epoch 1983 September 16, together with improved parabolic orbital elements. (no refs.)

121607 Periodic Comet Halley (1982i). M.J.S.Belton, P.A.Wehinger, S.Wyckoff.
I.A.U. Circ. (USA), no.3873, 1 pp. (4 Oct. 1983).
Two precise positions are reported for the epoch 1983 February 13, together with preliminary BV photometry for the same epoch. An R-magnitude is reported for the epoch 1982 October 20. (1 ref.)

121608 Comet Shoemaker (1983p). E.Everhart, A.C.Gilmore, B.Milet, B.Skiff, B.G.Marsden.
I.A.U. Circ. (USA), no.3874, 1 pp. (4 Oct. 1983).
Precise positions are reported for the period 1983 September 16 to 28. Improved parabolic orbital elements are presented, together with an ephemeris for the period 1983 November 2 to 1984 January 1 at ten-day intervals.

121609 Periodic Comet Crommelin (1983n). S.Koutchmy, P.Laques, J.Lecacheux.
I.A.U. Circ. (USA), no.3876, 1pp (5 Oct. 1983).
Reports three precise positions for the epoch 1983 September 4. (no refs.)

121610 Aphelion clustering of 'new' comets: star tracks through Oort's cloud. L.Biermann, W.F.Huebner, R.Lust (Max-Planck-Inst. fur Phys. & Astrophys., Inst. fur Astrophys., Garching, Germany).
Proc. Natl. Acad. Sci. USA, vol.80, no.16, p.5151-5 (Aug. 1983).
An explanation is proposed for the observed and often discussed clustering of long-period comet aphelia on the sky. Poisson and several multinomial distributions are applied to the most conspicuous cluster, considering only the 80 'new' and 59 'intermediate' comets with the best-determined orbits. The observed number of aphelion points in adjacent areas in two tests with 24 and 36 equal sky areas, respectively, shows a large deviation from a random distribution. The expected probability frequency for this to happen by chance is $<0.1\%$ for the'new' comets alone; it is further reduced when 'new' and 'intermediate' comets are combined. When these comets are analyzed separately from others, it is found that the clustering is the result of perturbations of their original orbits by the passage of a star, or a stellar system, through Oort's cloud a few million years ago. Because the statistical effect on the change of a comet's angular momentum about the Sun is proportional to the square of the ratio of the mass to the velocity of a star relative to the Sun, it is a priori probable that passages by a few stars should produce clustering of the aphelia, as is discussed in detail. (28 refs.)

The Tunguska event: no cometary signature in evidence .... See Entry 121570

Minor Planet Circulars 8085-8/82 .... See Entry 121581

96.50K Meteors, showers and meteoroids

Some consequences of meteoroid impacts on Saturn's rings ... See Entry 121591

96.50M Meteorites, micrometeorites

121611 The discovery and initial characterization of Allan Hills 81005: the first lunar meteorite. U.B.Marvin (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Geophys. Res. Lett. (USA), vol.10, no.9, p.775-8 (Sept. 1983).
Antarctic meteorite ALHA 81005, discovered in the Allan Hills region of Victoria Land, is a polymict anorthositic breccia which differs from other meteorites in mineralogical and chemical composition but is strikingly similar to lunar highlands soil breccias. The petrologic character and several independent lines of evidence identify ALHA 81005 as a meteorite from the Moon. Two small clasts of probable mare basalt occur among the highlands lithologies in Thin Section 81005,22. This lunar specimen, which shows relatively minor shock effects has generated new ideas on the types of planetary samples to be found on the Earth, and has added fresh excitement to the Antarctic meteorite program. (9 refs.)

121612 Regolith breccia Allan Hills A81005: evidence of lunar origin, and petrography of pristine and nonpristine clasts. P.H.Warren, G.J.Taylor, K.Keil (Dept. of Geology, Univ. of New Mexico, Albuquerque, NM, USA).
Geophys. Res. Lett. (USA), vol.10, no.9, p.779-82 (Sept. 1983).
MnO/FeO ratios in pyroxene, texture (abundant brown, swirly glass, in general typical of lunar regolith breccias), and overall composition ($\sim$75% plagioclase) all indicate that Allan Hills A81005 is of lunar origin. It is presumably from a heretofore unsampled region of the Moon. It differs in detail from other regolith samples, e.g. it has exceptionally low contents of Na and KREEP. A pristine clast contains exceptionally coarse augite, compared to similar Apollo samples. ALHA 81005 is not perceptibily more shocked than typical Apollo regolith breccias. Therefore, its discovery on Earth lends further credence to suggestions that shergottite-nakhlite chassignite achondrites were derived by impact ejection from Mars. (22 refs.)

121613 Origin of lunar meteorite ALHA 81005: clues from the presence of terrae clasts and a very low-titanium mare basalt clast. A.H.Treiman, M.J.Drake (Lunar & Planetary Lab., Univ. of Arizona, Tucson, AZ, USA).
Geophys. Res. Lett. (USA), vol.10, no.9, p.783-6 (Sept. 1983).
Petrographic data and pyroxene compositions indicate that meteorite ALHA 81005 is a breccia from the terrae of the Moon. Thin section ALHA 81005,9 includes ferroan anorthositic clasts, a lone clast of Mg-suite plutonic composition, fragments which are intermediate in composition between ferroan anorthosite and Mg-suite plutonics, and a clast of very low-titanium mare basalt. If this basalt is significantly younger than the last basin-forming impact event ($\simeq 3.9\times 10^9$ years ago), its presence probably constrains the source crater for ALHA 81005 to be within a hundred kilometers of a VLT mare basalt flow. (13 refs.)

121614 Petrology of ALHA 81005, the first lunar meteorite. S.B.Simon, J.J.Papike, C.K.Shearer (Inst. for the Study of Mineral Deposits, South Dakota School of Mines & Technol., Rapid City, SD, USA).
Geophys. Res. Lett. (USA), vol.10, no.9, p.787-90 (Sept. 1983).
Petrography and mineral compositions show tha ALHA 81005 is a lunar highland regolith breccia and is the first known lunar meteorite. Lithic clasts are abundant and most are members of the anorthosite-norite-troctolite highland suite. Plagioclase compositions in lithic clasts and single grains are calcic (An_{94-98}). Pyroxene compositions, Al-Ti and MnO-FeO relationships support a lunar highland origin. A non-KREEPy source region is indicated, and the unexplored far side of the Moon cannot be ruled out as a potential source. (11 refs.)

121615 ALHA 81005: Moon, Mars, petrography, and Giordano Bruno. G.Ryder, R.Ostertag (Inst. fur Mineralogie, Univ. Munster, Munster, Germany).
Geophys. Res. Lett. (USA), vol.10, no.9, p.791-4 (Sept. 1983).
Meteorite ALHA 81005, a glassy regolith breccia, is beyond any reasonable doubt of lunar origin, according to its petrographic, chemical, and isotropic characteristics. The sample was shocked at most to 15 GPa during ejection and supports and possibility of some meteorites being of Martian origin. Most lithic fragments are feldspathic granulitic impactites, cataclastic anorthosites, and impact melts, all typical lunar lithologies. Mineral fragments are derived from plutonic troctolitic and noritic rocks, varied mare basalt-like extrusive rocks, and the identified lithic fragment types. Neither petrographically nor chemically are there significant components in ALHA 81005 which were previously unknown. A mare basalt component restricts the origin of the sample: with remotely-sensed data, which eliminates most frontside, as well as farside groundtrack regions, it makes the probability of ejection from Giordano Bruno, near the Moon's NE limb, far greater than from any other lunar crater. (14 refs.)

121616 Meteorite ALHA 81005: petrology of a new lunar highland sample. G.Kurat, F.Brandstatter (Naturhistorisches Museum, Vienna, Austria).
Geophys. Res. Lett. (USA), vol.10, no.9, p.795-8 (Sept. 1983).
Reports a study of thin-section ALHA 81005,8 using microscopy and electron microprobe analysis techniques. (18 refs.)

121617 Oxygen and silicon isotopes in ALHA 81005. T.K.Mayeda, R.N.Clayton, C.A.Molini-Velsko (Enrico Fermi Inst., Univ. of Chicago, Chicago, IL, USA).
Geophys. Res. Lett. (USA), vol.10, no.9, p.799-800 (Sept. 1983).
The Antarctic meteorite ALHA 81005 has oxygen and silicon isotopic compositions identical with lunar highland rocks. The oxygen is distinctly unlike that in calcium-rich achondrites. The isotopic data are entirely consistent with a lunar origin for the meteorite. (10 refs.)

121618 Trapped noble gases indicate lunar origin for Antarctic meteorite. D.D.Bogard (Planetary & Earth Sci. Div., NASA Johnson Space Center, Houston, TX, USA), P.Johnson.
Geophys. Res. Lett. (USA), vol.10, no.9, p.801-3 (Sept. 1983).
The isotopic abundances of the noble gases (He, Ne, Ar, Kr, Xe) are reported for Antarctic meteorite ALHA 81005. It contains solar wind-implanted gases whose absolute and relative concentrations are quite similar to lunar regolith samples but not to other meteorites. ALHA 81005 also contains a large excess ^{40}Ar component which is identical to the component in lunar fines implanted from the lunar atmosphere. Large concentrations of cosmogenic ^{21}Ne, ^{82}Kr and ^{126}Xe in ALHA 81005 indicate a total cosmic ray exposure age of $\geq 2\times 10^8$ years. The noble gas data alone are strong evidence for a lunar origin of this meteorite. (15 refs.)

121619 Recent cosmic ray exposure history of ALHA 81005. C.Tuniz (Istituto di Fisica, Univ. di Trieste, Trieste, Italy), D.K.Pal, R.K.Moniot, W.Savin, T.H.Kruse, G.F.Herzog, J.C.Evans.
Geophys. Res. Lett. (USA), vol.10, no.9, p.804-6 (Sept. 1983).
Measurements of the ^{10}Be and ^{26}Al contents of ALHA 81005 constrain the length and conditions of its exposure to cosmic rays. Calculations based on one-step irradiation models imply that the time spent by this object in space is shorter than that spent by most 'asteroidal' meteorites. On the other hand the results are readily consistent with a lunar origin for ALHA 81005. (21 refs.)

121620 Ferromagnetic resonance and magnetic properties of ALHA 81005. R.V.Morris (NASA Johnson Space Center, Houston, TX, USA).
Geophys. Res. Lett. (USA), vol.10, no.9, p.807-8 (Sept. 1983).
Seven chips of primarily matrix material from the Antarctic meteorite ALHA 81005 were analyzed by ferromagnetic resonance (FMR) and magnetic hysteresis techniques. The FMR spectra of two chips have a resonance at g$\sim$2.1 that resembles the g$\sim$2.1 resonance that is characteristic of lunar soils. Thus the FMR spectra are consistent with the lunar regolith being a progenitor for the matrix material. For the two chips, I_s/FeO$\sim$5 units which is equivalent to a value for an immature lunar soil. The total concentration of metallic iron is on the order of 0.11 equivalent wt.% which is within the observed range of Apollo 16 rocks and soils. (17 refs.)

121621 Thermoluminescence and nuclear particle tracks in ALHA 81005: evidence for a brief transit time. S.R.Sutton, G.Crozaz (MacDonnell Center for the Space Sci., Washington Univ., St. Louis, MO, USA).
Geophys. Res. Lett. (USA), vol.10, no.9, p.809-12 (Sept. 1983).
Thermoluminescence and nuclear particle track measurements have been made on the Antarctic meteorite ALHA 81005. No nuclear particle tracks were found in lithic fragments indicating that the clast material never resided at the very surface of the parent body. The unusually low natural thermoluminescence of this material is interpreted as being due to a combination of anomalous fading and thermal decay. The thermal decay could be due to very long terrestrial age or heating either during atmospheric entry, in a near-Sun orbit or during a parent body impact event. Impact heating is considered the more likely of these possibilities for this meteorite. If the impact heating interpretation is correct the thermoluminescence data constrains the space exposure time of the object to be less than 2500 years. Such a brief Earth transit time is consistent with a lunar origin for this meteorite. (17 refs.)

121622 Antarctic meteorite ALHA 81005, a piece from the ancient lunar crust. H.Palme, B.Spettel, G.Weckwerth, H.Wanke (Max-Planck-Inst. fur Chem., Mainz, Germany).
Geophys. Res. Lett. (USA), vol.10, no.9, p.817-20 (Sept. 1983).
A 128 mg sample of the Antarctic meteorite ALHA 81005 was analysed for major, and trace elements by instrumental neutron activation techniques. The meteorite, or at least its major components, may be older than 4×10^9 years and represent a piece of the ancient lunar crust, before the formation of the large basins on the front-side of the Moon. The evidence is derived from the low absolute content of incompatible elements and their slightly different fractionation pattern from KREEP, the dominant source for these elements on the front-side. The basically chondritic pattern of siderophile elements (Ni, Co, Ir, Au) is clearly distinguished from younger, basin related, meteoritic components. (24 refs.)

121623 Siderophile, lithophile and mobile trace elements in the lunar meteorite Allan Hills 81005. R.M.Verkouteren, J.E.Dennison, M.E.Lipschutz (Dept. of Chem., Purdue Univ., West Lafayette, IN, USA).
Geophys. Res. Lett. (USA), vol.10, no.9, p.821-4 (Sept. 1983).
Contents of siderophilic As, Au, Co, Ga and Sb, volatile/mobile Ag, Bi, Cd, In, Se, Te, Tl and Zn and lithophilic Cs, Rb and U determined by radiochemical neutron activation analysis in ALHA 81005 are similar to those of lunar highlands samples returned by Apollo missions, indicating this meteorite's lunar origin. Five elements (Co, Ga and lithophiles) reflect lunar crustal processes while the remaining 11 siderophile and mobile elements (including the most mobile ones) indicate $1.4\pm 0.5\%$ micrometeorite (Cl equivalent) admixture or enrichment by thermal redistribution on the Moon. Thus, in contrast to L chondrites where severe shock caused trace element loss, impact-launching of ALHA 81005 to Earth was free of substantial ($\leq$20 GPa) shock loading. In this light, a Martian origin for severely shocked shergottite-nakhlite-chassignite meteorites is plausible. (28 refs.)

121624 ALHA 81005 meteorite: chemical evidence for lunar highland origin. J.C.Laul (Dept. of Radiological Sci., Battelle, Pacific Northwest Labs., Richland, WA, USA), M.R.Smith, R.A.Schmitt.
Geophys. Res. Lett. (USA), vol.10, no.9, p.825-8 (Sept. 1983).
Based on the well-established characteristic lunar and meteoritic ratios of FeO/MnO, Cr_2O_3/V and K/La, and REE patterns, ALHA 81005 meteorite is undoubtedly of lunar highland origin. The ALHA 81005 meteorite is an anorthositic gabbro (72% Pl) and matches closely in chemical composition to Apollo 15 15418 and Luna 16 21013 highland rocks. The rock is a non-KREEPy and VLT type. The siderophiles Au, Ni and Ir content is high (1.5% Cl equivalent) and similar to other lunar highland breccias. The clast has a different ancient meteorite component than the bulk and matrix. The meteorite has a young terrestrial age implying a recent lunar cratering event. Therefore, during major lunar basins formulation in early eons, the Earth must have received a significant amount of lunar material which is now mixed in the crust. The finding of a lunar meteorite lends credibility to the suggestion that SNC achondrites may come from Mars. (30 refs.)

121625 Antarctic meteorite ALHA 81005—not just another lunar anorthositic norite. R.L.Korotev, M.M.Lindstrom, D.J.Lindstrom, L.A.Haskin (McDonnell Center for the Space Sci., Washington Univ., St. Louis, MO, USA).
Geophys. Res. Lett. (USA), vol.10, no.9, p.829-32 (Sept. 1983).
Seven subsamples of meteorite ALHA 81005, a regolith breccia from the lunar highlands, have been analyzed by INAA for 32 elements. Four of them were also studied petrographically. In bulk composition the rock corresponds to anorthositic norite with a very small component of KREEP and is very similar to estimates of average lunar highlands surface. Compositions of the white clasts and the dark matrix are similar, but the clasts are more magnesium and 30-50% as rich in KREEP-related elements. The white clasts have fine-grained granulitic textures and are generally similar to Apollo 16 and 17 granulitic anorthositic norites, but are more magnesian and only 20% as rich in KREEP-related elements. Some granulitic clasts are dominated by a magnesian anorthositic norite component not represented among the 'pristine' Apollo samples. (19 refs.)

121626 Compositional implications regarding the lunar origin of the ALHA 81005 meteorite. G.W.Kallemeyn (Dept. of Chem. & Biochem., Univ. of California, Los Angeles, CA, USA), P.H.Warren.
Geophys. Res. Lett. (USA), vol.10, no.9, p.833-6 (Sept. 1983).
Geochemically, ALHA 81005 has all the attributes expected of a regolith sample from the lunar highlands. Most important is its Fe/Mn ratio (77), within uncertainty the same as the mean lunar ratio. There are significant differences, however, in comparison to previously sampled lunar regoliths. The closest precedents are the Apollo-16 and Luna-20 regoliths, particularly the latter, but ALHA 81005 has lower contents of Na, Ti, and incompatible elements. Feldspathic granulitic breccias such as 72559, which texturally resemble the most abundant type of clast in ALHA 81005, are also similar compositionally. From its low KREEP and Na contents ALHA 81005 originated well away from the K, Th, and U-rich region near the center of the nearside, at least as far away as the eastern limb. (24 refs.)

121627 Composition of bulk samples and a possible pristine clast from Allan Hills A81005. W.V.Boynton, D.H.Hill (Lunar & Planetary Lab., Univ. of Arizona, Tucson, AZ, USA).
Geophys. Res. Lett. (USA), vol.10, no.9, p.837-40 (Sept. 1983).
Abundances of thirty-five elements were determined in two bulk samples and a white clast in the Allan Hills A81005 meteorite. High siderophile element content indicates that the sample is a regolith breccia. An Fe/Mn ratio of 77 in this meteorite eliminates parent bodies of known differentiated meteorites as the source of ALHA 81005. The incompatible elements are very similar to those found in most lunar highlands rocks, and provide very strong evidence that the sample is lunar in origin. The clast sample has the trace element pattern of a lunar anorthosite and is very low in KREEP and siderophile elements. It may be a fragment of a pristine lunar rock. (12 refs.)

121628 Al-Sm-Eu-Sr systematics of eucrites and Moon rocks: implications for planetary bulk compositions. P.H.Warren (Dept. of Geology, Univ. of New Mexico, Albuquerque, NM, USA).
Geochim. & Cosmochim. Acta (GB), vol.47, no.9, p.1559-71 (Sept. 1983).
Analysis of the Eu and Sr 'anomalies' of eucrites and lunar rocks allows constraints to be placed on the bulk compositions of the eucrite parent body (EPB) and the Moon. The elements Al, REE, and Sr, all are essentially incompatible with the major minerals of these small, low-f (O_2) bodies, except for plagioclase, into which Al, Sr, and Eu tend to concentrate. Therefore, the hypothesis that Al, REE, and Sr in the EPB and the Moon are all in proportions close to those in the bulk solar system (i.e. chondrites) leads to certain predictions about the concentrations of these elements in samples affected by plagioclase fractionation. the predictions are almost ideally fulfilled by eucrites and lunar samples. (100 refs.)

121629 Cumberland Falls chondritic inclusions. II. Trace element contents of forsterite chondrites and meteorites of similar redox state. R.M.Verkouteren, M.E.Lipschutz (Dept. of Chem., Purdue Univ., W. Lafayette, IN, USA).
Geochim. & Cosmochim. Acta (GB), vol.47, no.9, p.1625-33 (Sept. 1983).
For pt.I see ibid., vol.45, no.11, p.2091-107 (1981). Mineralogic study of black inclusions in the Cumberland Falls enstatite achondrite revealed that they constitute a highly unequilibrated chondritic suite distinct from other chondrite groups. This highly shocked suite, the forsterite (F) chondrites, exhibits mineralogic trends apparently produced during primary nebular condensation and accretion over a broad redox range. These samples and possibly related meteorites are analysed for Ag, As, Au, Bi, Cd, Co, Cs, Ga, In, Rb, Sb, Se, Te, Tl, U and Zn. Chemical trends in F chondrites apparently reflect primary nebular processes. Cosmochemical fractionation of lithophiles from siderophiles and chalcophiles occurred at moderately high temperatures, certainly higher than those existing during formation of primitive carbonaceous, enstatite and ordinary chondrites of petrologic type ≤ 3. (48 refs.)

121630 FUN with PANURGE: high mass resolution ion microprobe measurements of Mg in Allende inclusions. J.C.Huneke, J.T.Armstrong, G.J.Wasserburg (Div. of Geological & Planetary Sci., California Inst. of Technol., Pasadena, CA, USA).
Geochim. & Cosmochim. Acta (GB), vol.47, no.9, p.1635-50 (Sept. 1983).
The performance characteristics of PANURGE, a modified CAMECA IMS3F ion microprobe, have been studied at a mass resolving power of 5000. Using this instrument the isotropic composition of Mg and Si and the atomic ratio of Al/Mg in minerals from the Allende inclusion WA and the Allende FUN inclusion C1 have been measured. Enrichments in ^{26}Mg of up to $260^0\%$ have been found. Mg and Al/Mg measurements on cogenetic spinel inclusions and host plagioclase crystals yield Mg/Al isochrons in excellent agreement with precise mineral isochrons determined by thermal emission mass spectrometry. The measurements confirm the presence of substantial excess ^{26}Mg in WA and its near absence in C1. This suggests a metamorphic reequilibration of Mg in Allende plagioclase at least 0.6 my after WA formation. (42 refs.)

121631 Description, chemical composition and noble gases of the chondrite Nogata. M.Shima, S.Murayama (Nat. Sci. Museum, Tokyo, Japan), A.Okada, H.Yabuki, N.Takaoka.
Meteoritics (USA), vol.18, no.2, p.87-102 (30 June 1983).
An ordinary chondrite weighing 472 g kept in the Shinto shrine, Suga Jinja, Nogata-shi, Fukuoka-ken, Japan, as treasure, was said to have fallen in the precinct of the shrine, approximately 130°45.0′E and 33°43.5′N, on May 19, 861 AD. The data of fall was confirmed by old literature, as well as written script on, and ^{14}C age determination of, the lid of the wooden box in which it has been stored. The chondrite was named Nogata after the present name of the place of fall. Chemical analyses indicate that Nogata is an L-group chondrite. It is classified as petrologic type 6. Nogata contains rather high amounts of both radiogenic and spallogenic light noble gases, and gives gas retention ages and cosmic-ray-exposure ages of 4.5 and 4.7×10^9 and 4.00×10^7 years, respectively. It is concluded that metamorphism of this chondrite was completed just after the formation of the parent body in a very short interval, $\lesssim 10^8$ years, with subsequent quiescence. (43 refs.)

121632 The nomenclature of polymict basaltic achondrites. J.S.Delaney, H.Takeda, M.Prinz, C.E.Nehru, G.E.Harlow (Dept. of Mineral Sci., American Museum of Natural History, New York, NY, USA).
Meteoritics (USA), vol.18, no.2, p.103-11 (30 June 1983).
The subgroups within the basaltic achondrite suite are defined using the structural criterion of Wahl (1952). The 'monomict' meteorites are samples of a single lithology while the polymict meteorites are those containing two or more lithologies. The 'monomict' subgroups; eucrites, cumulate eucrites and diogenites are subdivided into both brecciated and unbrecciated meteorites. The polymict achondrites sample a petrological-compositional continuum that contains both mafic and ultramafic rock types and may be subdivided into several groups. Two groups of polymict basaltic achondrites, the polymict eucrites and howardites are separated using an arbitrarily defined criterion. The recommended criterion is based on the amount of magnesium orthopyroxenite (diogenite) component in the meteorite. (36 refs.)

121633 The Atlanta enstatite chondrite breccia. A.E.Rubin (Dept. of Mineral Sci., Nat. Museum of Natural History, Washington, DC, USA).
Meteoritics (USA), vol.18, no.2, p.113-21 (30 June 1983).
Atlanta is the fifth known brecciated enstatite chondrite. It contains a centimeter-sized troilite-rich clast, similar to those that occur in Blithfield. All of these clasts probably formed in the solar nebula under high pS_2/pO_2 conditions in a gas of non-cosmic composition. The absence of ordinary or carbonaceous chondrite clasts in any of the enstatite chondrite breccias and absence of enstatite chondrite clasts or materials formed at high pS_2/pO_2 ratios in ordinary and carbonaceous chondrite breccias support the model that enstatite chondrites were formed at a location distant from those of the other chondritic groups. (20 refs.)

121634 Lithium in stone meteorites and stony irons. S.V.S.Murty, P.N.Shukla, P.S.Goel (Dept. of Chem., Indian Inst. of Technol., Kanpur, India).
Meteoritics (USA), vol.18, no.2, p.123-36 (30 June 1983).
Lithium contents have been determined by neutron activation analysis in 54 meteorites distributed as: C(9), H(13), L(10), LL(3), E(2), achondrites (11), and stony irons (6). Among the undifferentiated meteorites Li contents range from 1 to 3 ppm. Li contents are higher in Ca-rich achondrites and mesosiderites than in Ca-poor achondrites and pallasites respectively. Among achondrites, Li correlates positively with Ca and Al and inversely with Mg. A minor Li-rich phase might be associated with the plagoclase component of achondrites. In several meteorites, Li concentration is determined in magnetic and nonmagnetic fractions, chondrules, and light and dark components (for the gas-rich meteorites). (44 refs.)

121635 Brianza: an example of wrongly believed chondrite. G.R.Levi-Donati (Istituto Tec. Ind. di Stato A. Volta, Perugia, Italy), R.S.Clarke,Jr..
Meteoritics (USA), vol.18, no.2, p.165-6 (30 June 1983).
The results obtained from the specimen labelled Brianza revealed that it is an artificial iron and not a chondritic meteorite, as previously supposed. (4 refs.)

121636 Fe-Ni-S-O layer phase in C2M carbonaceous chondrites—a hydrous sulphide?. D.J.Barber (Phys. Dept., Univ. of Essex, Colchester, England), A.Bourdillon, L.A.Freeman.
Nature (GB), vol.305, no.5932, p.295-7 (22 Sept. 1983).
It has been suggested (McSween, 1979, and Bunch and Chang 1980) that the matrix minerals of type C2M carbonaceous meteorites are the products of aqueous alteration in a parent-body regolith. Phases occur within the matrix which differ from those commonly found in cases of terrestrial aqueous alteration and provide clues to the history of the meteorites. Poorly-characterized phases $(PCP)^3$ containing Fe, Ni, S, O and sometimes Cr, were first noted in the Murchison meteorite. Barber (1981) found that amongst PCP there was a layer phase, rich in Fe, Ni, S and thought to contain oxygen, commonly having a fibrous or platey morphology, with a layer spacing of approximately 10.8 and 5.4 Å. The authors report new data on this phase, obtained by high resolution electron microscopy, dispersive X-ray spectrometry and electron energy loss spectrometry. (19 refs.)

121637 Martian gases in an Antarctic meteorite?. D.D.Bogard, P.Johnson (Planetary & Earth Sci. Div., NASA Johnson Space Center, Houston, TX, USA).
Science (USA), vol.221, no.4611, p.651-4 (12 Aug. 1983).
Significant abundances of trapped argon, krypton and zenon have been measured in shock-altered phases of the achondritic meteorite Elephant Moraine 79001 from Antarctica. The relative elemental abundances, the high ratios of argon-40 to argon-36 ($\geq$2000), and the high ratios of xenon-129 to xenon-132 ($\geq$2.0) of the trapped gas more closely resemble Viking data for the Martian atmosphere than data for noble gas components typically found in meteorites. These findings support earlier suggestions, made on the basis of geochemical evidence, that shergottites and related rare meteorites may have originated from the planet Mars. (25 refs.)

A method for the identification and elimination of contamination during carbon isotropic analyses of extraterrestrial samples .... See Entry 121547

Possible lunar source areas of meteorite ALHA 81005: geochemical remote sensing information .... See Entry 121557

Asteroids and meteorites: parent bodies and delivered samples .... See Entry 121574

96.60 SOLAR PHYSICS

121638 Oscillator strengths of titanium and chromium ionic lines. R.I.Kostyk, T.V.Orlova.
Astrometriya & Astrofiz. (USSR), no.49, p.39-41 (1983). In Russian.
Oscillator strengths for 27 Ti II and 29 Cr II lines are determined from the solar spectrum with suggested accuracy of ±0.15 dex. (15 refs.)

121639 Sounding of the supercorona by decametric radiation of 3C 144. E.P.Abranin, L.L.Bazelyan.
Astrometriya & Astrofiz. (USSR), no.49, p.41-7 (1983). In Russian.
Angular intensity distributions are presented for the 3C 144 source measured at 25 MHz during its occultation by the solar corona. The distributions obtained are compared with those calculated for the case of a spherically symmetric solar corona with irregularities elongated in radial directions. Application of the mean and scattering solar corona's model elongated in equatorial plane is shown to be necessary for explanation of the distribution observed. (4 refs.)

121640 Annual variation of the mean magnetic field of the Sun. V.A.Kotov, L.S.Levitskii, N.N.Stepanyan.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.1-14 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.3-14 (1981). [received: Oct. 1983]
Measurements of the mean magnetic field of the Sun, seen as a star, were carried out between 1968 and 1978 at three observatories. Analysis of these data have shown that the mean magnetic field (MMF) exhibits a clear annual periodicity with an amplitude of about 0.1 G. An analogous annual wave has also been found in the background field determined from sunoptic Hα-charts. This annual periodicity cannot be ascribed to instrumental or seasonal factors. In contrast to the polar field the variation in the solar MMF cannot be explained in a purely geometric fashion because this leads to a large discrepancy with direct observations. The origin of this annual variation remains an open question. (33 refs.)

121641 Quasiperiodic oscillations in the solar atmosphere. A.G.Kosvichev, Yu.P.Popov.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.15-26 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.15-24 (1981). [received: Oct. 1983]
The propagation of disturbances through the convective zone and the atmosphere of the Sun is investigated with the aid of numerical methods applied to the equations of one-dimensional gravitational gas-dynamics. It is shown that the inhomogeneity of the solar plasma in the gravitational field gives rise to oscillations in the solar atmosphere with a period of about 300 sec. The effect of nonlinearity on the nature of these oscillations is established. The results obtained are compared with observational data. (18 refs.)

121642 The structure of the magnetic field and its evolution in the neighbourhood of sunspots. S.I.Gopasyuk, L.G.Kartashova.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.27-47 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.25-54 (1981). [received: Oct. 1983]
The structure of the magnetic field and its evolution have been investigated in the neighbourhood of large single sunspots. Charts of the longitudinal magnetic field at the level of the photosphere and Hα-photographs of 18 active

regions were employed. For five active regions the data were augmented with X-ray photographs of the Sun. It is shown that an active region contains characteristic directions along which the spot field varies withut change of sign as it passes into an extended field region of the same polarity. These directions correspond to channels along which the magnetic lines of force leave and active region or close upon it. (18 refs.)

121643 Structure of the magnetic field and flare activity in the active region McMath 9740 (October 1968). M.B.Ogir, T.T.Tsap.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.48-67 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.46-65 (1981). [received: Oct. 1983]
The active region McMath 9740 was investigated between 26 October and 2 November 1968. The longitudinal and transverse components of the solar magnetic field were recorded in the Fe I 5250 Å line. These measurements were accompanied by simultaneous Hα-cinematography. It was found that flares of size Sn or higher were grouped in definite time intervals, forming flare series. All the first appearances of flares were located very close to the neutral line of the longitudinal magnetic field; strong flares appeared at points corresponding to strong transverse fields. (41 refs.)

121644 Nature of solar radio burst spectra in frequency band 0.245-35 GHz. T.K.Das, M.K.Das Gupta (Centre of Advanced Study in Radio Phys. & Electronics, Calcutta, India).
Indian J. Radio & Space Phys., vol.12, no.3, p.68-73 (June 1983).
A total of 132 solar radio burst spectra in the frequency band 0.245-35 GHz are classified into 15 distinct types according to the nature of variation of emission intensity with the observed frequencies. Of these 15 types, IU-IU, IU-I, D-IU, D-I and U-IU occur most. They generally have the most pronounced peaks at 0.245-0.606 GHz and the less pronounced peaks at around 8.8 GHz. The mean spectral indices in the ranges of frequencies 0.245-0.606, 1.415-2.695 and 4.995-15.4 GHz are 2.7, 1.3 and 1.0, respectively. In the decimetre-wave region the burst having U-shaped spectra correlate well with type II metre-wave bursts and proton events, and the bursts having LS-shaped spectra with type III bursts. In the centimetre-wave region. IF-type spectra are associated with type III bursts and proton events and the D-type ones with type II bursts. The spectral shapes are interpreted. (27 refs.)

121645 On propagation of magneto-acoustic-gravity waves in the solar atmosphere. N.S.Dzhalilov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.1, p.90-8 (1983). In Russian.
The coupling of magneto-acoustic-gravity waves (MAG) at the sharp boundary between two isothermal atmospheres which are perpendicular to the magnetic field is investigated. The energetic and amplitude reflection, transmission and transformation coefficients for MAG waves incident on a temperature step are calculated. The results of the investigation are used for the evaluation of the wave flux and the wavelengths crossing the transition layer of the Sun's atmosphere. (18 refs.)

121646 Simultaneous acceleration of electrons and ions in solar flares. D.J.Forrest, E.L.Chupp (Univ. of New Hampshire, Dept. of Phys., Durham, NH, USA).
Nature (GB), vol.305, no.5932, p.291-2 (22 Sept. 1983).
Two very intense and impulsive nuclear γ-ray and electron bremsstrahlung X-ray emitting solar flares, on 7 and 21 June 1980, were observed with <2 s time resolution. These observations allow the authors to study the relative starting times of energetic ion and electron interactions with the solar atmosphere. The simultaneous starting times of X-rays$>$40 keV and γ-ray emission show that electrons and ions were accelerated within seconds of each other. The near simultaneous peaking, together with the observation of $>$400 MeV neutrons, show that the solar flare acceleration process can produce the full intensity and spectrum of electrons ($>$1 MeV) and ions ($>10^2$ MeV) in a time scale of <5 s. (18 refs.)

121647 Successive electron and ion accelerations in impulsive solar flares on 7 and 21 June 1980. H.Nakajima, T.Kosugi, K.Kai (Nobeyama Solar Radio Obs., Tokyo Astron. Obs., Nagano-ken, Japan), S.Enome.
Nature (GB), vol.305, no.5932, p.292-4 (22 Sept. 1983).
A study of the relative timing of solar flare emissions at different wavelengths can provide valuable insights into the associated particle-acceleration mechanisms. The authors report that the significant systematic differences between the times of occurrence of the peak intensities of microwave, hard X-ray and γ-ray line emissions, which were found in two impulsive flares on 7 and 21 June 1980 at 0312 and 0118 UT respectively, suggest that two kinds of acceleration take place successively within a few seconds. (10 refs.)

121648 Neutrino astrophysics and neutrino rest mass. II. Solar neutrinos and stellar collapse neutrinos. T.Kirsten (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).
Phys. Bl. (Germany), vol.39, no.9, p.313-17 (Sept. 1983). In German.
This part deals with experiments for the detection of solar neutrinos. Only fusion-generated neutrinos, because of their minimal interaction with matter, permit a glimpse of the otherwise inaccessible solar interior, and provide a test of the author's theories of stellar structure. The neutrino mass is of importance, because of the possible oscillation between neutrino types which could affect measurements of the solar neutrino flux. Even with a rest mass corresponding to less than 10^{-3} eV, a gallium detector should yield information in this area. To conclude, neutrino pulses from the collapse of dying stars are discussed. (10 refs.) *G.F.F.*

121649 27-day variations observed in solar UV (120-300 nm) irradiance. G.J.Rottman (Lab. for Atmospheric & Space Phys., Univ. of Colorado, Boulder, CO, USA).
Planet. & Space Sci. (GB), vol.31, no.9, p.1001-7 (1983). (European Geophysical Society Meeting on the Structure of the Upper and Middle Atmosphere, Leeds, England, 23-27 Aug. 1982).
A Fourier transform analysis of 256 days of SME solar irradiance data (115-303 nm) provides an estimate of the root mean square 27-day solar variation. The magnitude of this 27-day variation exceeds ±10% at 120 nm and decreases with increasing wavelength to less than 1% above 260 nm. Qualitative aspects of the analysis include a striking decrease in the per cent variation across the aluminium absorption edge near 208 nm. (7 refs.)

121650 Neutrino spectroscopy of the solar core. Yu.S.Kopysov.
Priroda (USSR), no.8, p.59-69 (1983). In Russian.
The author traces the history of attempts to detect and measure the streams of neutrinos generated by the nuclear reactions taking place in the Sun, and traversing space at the speed of light. The author then discusses in detail the astrophysical and nucleophysical aspects of the problem of detection and measurements of solar neutrinos, in particular that of using the data so obtained to model and explain the structure of the Sun. The author proposes an explanation of pulsing neutrino streams based on tidal-type oscillations of the solar substance. An account is given of the detection equipment and the methods to be used at the nearly completed solar neutrino observatory at Andyrcha in the USSR. (no refs.) *A.J.B.*

121651 Infrared observations of the thermal emission from the corona. A.Mampaso, C.Sanchez-Magro (Inst. de Astrofisica de Canarias, Univ. de La Laguna, La Laguna, Tenerife, Spain), M.J.Selby, A.D.MacGregor.
Rev. Mex. Astron. & Astrofis. (Mexico), vol.8, no.1, p.3-6 (June 1983).
During the summer of 1978 the F Corona was observed from the ground in the near infrared at 2.2 μm and 3.5 μm in an attempt to measure the localized thermal emission from dust predicted by Peterson (1963) and several other workers. The authors failed to detect this emission even though their experimental errors were well below previously quoted emission values. If thermal emission peaks around the Sun exist, the authors believe they are either much weaker or have different shapes compared to previous ones found. This result, if confirmed, will require a revision of the dynamics and physics of circumsolar dust. (19 refs.)

121652 Development of flare morphology in X-rays, and the flare scenario. C.de Jager (Kyoto Univ., Kyoto, Japan).
Sol. Phys. (Netherlands), vol.86, no.1-2, p.21-32 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Defines the impulsive phase of a flare as its first phase, characterized by: X-ray bursts of short (seconds to tens of seconds) duration, a patchy X-ray morphology, and injection of energy. It lasts some five to ten minutes. The gradual or diffuse phase starts virtually at the same time as the impulsive one and is characterized by a gradually varying X-ray flux from a larger, diffuse, area situated higher than the sources of the impulsive X-ray bursts. It contains about the same number of energetic electrons as the impulsive burst patches contained initially. It cools gradually down by radiative and conductive losses, a process that may last for about an hour. (11 refs.)

121653 Magnetic theories of solar flares. E.R.Priest (Appl. Math. Dept., Univ. of St. Andrews, St. Andrews, Scotland).
Sol. Phys. (Netherlands), vol.86, no.1-2, p.33-45 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
The basic processes of evaporation and magnetic reconnection are developed. They may be important in the two main types of flaring event, namely simple-loop flares and two-ribbon flares. The first type could be produced by kink instability, thermal nonequilibrium, or emerging flux. The second type is thought to be the result of an eruptive MHD instability that is either spontaneous or triggered from outside. After the eruption the magnetic field lines that have been blown open reconnect back down in a way that has now been simulated numerically. (50 refs.)

121654 Solar flare X-ray spectra from the P78-1 spacecraft. G.A.Doschek (E.O. Hulburt Center for Space Res., Naval Res. Lab., Washington, DC, USA).
Sol. Phys. (Netherlands), vol.86, no.1-2, p.49-58 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Results from the high resolution solar X-ray spectrometer experiments on the P78-1 spacecraft are discussed. These results concern physical quantities such as electron temperature and density, turbulence, mass motions, and state of ionization equilibrium, characteristic of the thermal soft X-ray emitting flare plasma, and the time behavior of these quantities during flares. In addition, a brief description of the instruments is given, the plasma diagnostics used in interpreting the spectra are summarized, and the origin of the thermal soft X-ray emitting plasma is discussed in light of the P78-1 results, earlier data, and numerical simulations of magnetic flux tubes heated to solar flare temperatures. (21 refs.)

121655 Non-thermal and non-equilibrium effects in soft X-ray flare spectra. A.H.Gabriel (Rutherford Appleton Lab., Chilton, Didcot, England), E.Antonucci, L.Steenman-Clark.
Sol. Phys. (Netherlands), vol.86, no.1-2, p.59-66 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Processes leading to the excitation of soft X-ray line spectra are discussed in relation to their thermal or non-thermal nature. Through analysis of calcium spectra from the XRP experiment on SMM, it is shown that the ionization balance during the gradual phase of flares is effectively in the steady-state. A search of suitable complex flares with multiple impulsive features has shown indications of soft X-ray line intensity anomalies, consistent with the presence of a non-thermal electron component. (10 refs.)

121656 Observation of chromospheric evaporation during the Solar Maximum Mission. E.Antonucci (Univ. di Torino, Torino, Italy), B.R.Dennis.
Sol. Phys. (Netherlands), vol.86, no.1-2, p.67-77 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
A sample of flares detected in 1980 with the Bent Crystal Spectrometer and the Hard X-ray Burst Spectrometer on the Solar Maximum Mission satellite are analysed to study the upward motions of part of the soft X-ray emitting plasma. These motions are inferred from the presence of secondary blue-shifted lines in the Ca XIX and Fe XXV spectral regions during the impulsive phase disk flares. The temporal association of these upward motions with the rise of the thermal phase and with the impulsive hard X-ray burst, as well as considerations of the plasma energetics, favour the interpretation of this phenomenon in terms of chromospheric evaporation. The two measureable parameters of the evaporating plasma, emission measure and velocity, depend on parameters related to the energy deposition and to the thermal phase. (9 refs.)

121657 Transport and containment of plasma, particles and energy within flares. L.W.Acton, W.A.Brown, M.E.C.Bruner, B.M.Haisch, K.T.Strong (Lockheed Palo Alto Res. Lab., Palo Alto, CA, USA).
Sol. Phys. (Netherlands), vol.86, no.1-2, p.79-90 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Results from the analysis of flares observed by the Solar Maximum Mission (SMM) and a recent rocket experiment are discussed. The authors find evidence for primary energy release in the corona through the interaction of magnetic structures, particle and plasma transport into more than a single magnetic structure at the time of a flare and a complex and changing magnetic topology during the course of a flare. The rocket data are examined for constraints on flare cooling, within the context of simple loop models. These results form a basis for comments on the limitations of simple loop models for flares. (27 refs.)

121658 Interpretation of the soft X-ray spectra from Hinotori. K.Tanaka (Tokyo Astron. Obs., Univ. of Tokyo, Tokyo, Japan), N.Nitta, K.Akita, T.Watanabe.
Sol. Phys. (Netherlands), vol.86, no.1-2, p.91-100 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Presents analyses of the soft X-ray iron line spectra of flares obtained from the Bragg spectrometer on Hinotori. The authors present a case of strong K_α

emission at the impulsive phase of the hard X-ray burst, and assess net K_α emission due to the electron impact by eliminating the fluorescence contribution. The authors discuss the differences in the electron temperatures and emission measures derived respectively from Fe XXVI and Fe XXV spectra. A pilot two-temperatures model which can explain the two spectra is presented. The authors compare the temporal relations between the soft X-ray and hard X-ray intensities and show two extreme classes of flares. Energetical relation of the thermal plasma to the electron beam is discussed for the two classes. (17 refs.)

121659 Polarization measurements using the Bragg crystal spectrometers on Hinotori. K.Akita (Dept. of Astron., Univ. of Tokyo, Tokyo, Japan), K.Tanaka, T.Watanabe.
Sol. Phys. (Netherlands), vol.86, no.1-2, p.101-5 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
The two Bragg crystal spectrometers on board Hinotori provide a new technique for measuring linear polarization of the soft X-ray line emission from solar flares. The results of the measurements of large (X class) flares are given and the polarization degree averaged over the soft X-ray maximum phases is estimated. (8 refs.)

121660 Thermal evolution of flare plasma. T.Watanabe, K.Tanaka (Tokyo Astron. Obs., Univ. of Tokyo, Tokyo, Japan), K.Akita, N.Nitta.
Sol. Phys. (Netherlands), vol.86, no.1-2, p.107-13 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
The evolution of hot thermal plasma in solar flares is analyzed by a single-temperature model applied to continuum emission in the 5 keV$<E<$13 keV spectral range. The general trend that the thermal plasma observed in soft X-rays is heated by the non-thermal electrons that emit as the hard X-ray bursts is confirmed by the observation of an electron temperature increase at the time interval of hard X-ray spikes and a quantitative comparison between thermal energy content and hard X-ray energy input. Non-thermal electrons of 10 keV$<E<$30 keV energy may play an important role in pre- and post-burst phases. (5 refs.)

121661 Conductive flux in the chromosphere derived from line linear polarization observations. J.-C.Henoux, G.Chambe, D.Heristchi, M.Semel (Obs. de Paris, Meudon, France), B.Woodgate, D.Shine, J.Beckers.
Sol. Phys. (Netherlands), vol.86, no.1-2, p.115-22 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Linear polarization in two chromospheric lines (Hα and S I 1437 A) was observed in the gradual phase of solar flares. This polarization could be due to collisional excitation of hydrogen and S I by energetic electrons beamed in the vertical direction. The heat flux in the region connecting the transition zone to the high chromosphere during the gradual phase of a flare could lead to an anisotropic excitation. Selecting a function which represents the velocity distribution of electrons carrying heat flux, the relationship between conductive heat flux and linear line polarization is computed. The application of the relationship between linear polarization and heat flux to the observed degree of polarization leads to the determination of the conductive heat flux in the high chromosphere. (12 refs.)

121662 Upper limits on the total radiant energy of solar flares. H.S.Hudson (Center for Astrophys. & Space Sci., Univ. of California, La Jolla, CA, USA), R.C.Willson.
Sol. Phys. (Netherlands), vol.86, no.1-2, p.123-30 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Establishes limits on the total radiant energy of solar flares during the period 1980 February-November, using the solar-constant monitor (ACRIM) on board the Solar Maximum Mission. Typical limits amount to 6×10^{29} erg/s for a 32-second integration time, with 5 σ statistical significance, for an impulsive emission; for a gradual component, about 4×10^{32} ergs total radiant energy. The limits lie about an order of magnitude higher than the total radiant energy estimated from the various known emission components, suggesting that no heretofore unknown dominant component of flare radiation exists. (12 refs.)

121663 Energetic electrons as an energy transport mechanism in solar flares. A.G.Emslie (Dept. of Phys., Univ. of Alabama, Huntsville, AL, USA).
Sol. Phys. (Netherlands), vol.86, no.1-2, p.133-46 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Reviews the observations and theory relating to the role of energetic electrons in the solar flare, with particular emphasis on discriminating between 'thermal' and 'nonthermal' origins of these electrons. The author discusses diagnostics in hard X-rays, especially those relating to the recent observations of the SMM and Hinotori satellites. He briefly addresses the response of the atmosphere to energy input in the form of high energy electrons, in particular through the diagnostics of both the Fe Kα feature and optically thin transition region lines such as OV. He finally discusses the relative roles of electron and proton heating in γ-ray flare events. (75 refs.)

121664 Hydrodynamics of flaring loops: SMM observations and numerical simulations. R.Pallavicini (Osservatorio Astrofisico di Arcetri, Firenze, Italy), G.Peres.
Sol. Phys. (Netherlands), vol.86, no.1-2, p.147-57 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
The hydrodynamic response of confined magnetic structures to strong heating perturbations is investigated by means of a time-dependent one-dimensional code which incorporates the energy, momentum and mass conservation equations. The entire atmospheric structure from the chromosphere to the corona is taken into account. The results of model calculations are compared with observations of flares obtained with the X-ray polychromator experiment on the solar maximum mission. (8 refs.)

121665 Behavior of transition-region lines during impulsive solar flares. E.Tandberg-Hanssen, E.Reichmann (NASA/MSFC, Al, USA), B.Woodgate.
Sol. Phys. (Netherlands), vol.86, no.1-2, p.159-71 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Describes the ultraviolet spectrometer and polarimeter on the solar maximum mission and discusses data pertaining to the emissions observed in lines originating in the transition-region plasma, particularly during impulsive flares. The data pertain to lines from the following ions: Si II, C IV, O IV, Si IV, O V, and Fe XXI. (13 refs.)

121666 The optical flare. H.Zirin (Big Bear Solar Obs., California Inst. of Technol., Pasadena, CA, USA).
Sol. Phys. (Netherlands), vol.86, no.1-2, p.173-84 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Optical observations now present considerable information on the flare process. It is always associated with filaments and with simplification of existing magnetic connections, and it arises from the emergence and expansion of new flux. The optical flare divides into impulsive phase, with multiple flashes along the neutral line, and thermal phase, with two-ribbon expansion. The former bears some resemblance to tearing mode phenomena. The appearance of loops in emission requires very high densities in those phenomena. (12 refs.)

121667 Observation of the flare of 12 June 1982 by Norikura coronagraph and Hinotori. E.Hiei, T.Okamoto, K.Tanaka (Tokyo Astron. Obs., Univ. of Tokyo, Tokyo, Japan).
Sol. Phys. (Netherlands), vol.86, no.1-2, p.185-91 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Flare activity was observed near the limb with two coronagraphs at the Norikura Solar Observatory and the soft X-ray crystal spectrometer (SOX) aboard Hinotori. A prominence activation occurred and then H_α brightenings were seen on the disk near the prominence. The prominence became very bright and its electron density increased to $10^{12.8}$ cm^{-3} in 1/2 hour. Loop prominence systems appeared above the H_α brightenings about half an hour after the onset of the flare, and were observed in the coronal lines Ca XV 5694 Å, Fe XIV 5303 Å, and Fe X 6374 Å. Shifted and asymmetric profiles of the emission line of 5303 Å were sometimes observed, and turbulent phenomena occurred even in the thermal phase. The energy release site of the flare at the onset would be lower than 20000 km above the solar limb. (7 refs.)

121668 Positional measurements on the eruptive loop prominence of 27 April 1981 and comparison with the X-ray sources. Li Su-Cuan (Yunnan Astronomical Obs., Acad. Sinica, Kunming, China), Cao Tian-Jun.
Sol. Phys. (Netherlands), vol.86, no.1-2, p.197-202 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Using the Hα observational data from Yunnan Observatory, the authors have made position measurements on the eruptive loop prominence of 27 April 1981, and compare the results with the positions of X-ray sources obtained by the hard X-ray telescope (SXT) on board the Hinotori satellite. From the results of measurement and comparison, it is suggested that: (1) The two mounds A and C at 0830 UT are extensions of two ribbons in the flare near the limb, which started before 0758 UT. (2) The central positions of two X-ray sources at 0756 UT are just situated at the top of the mound A and the mound C, respectively. The Hα footpoint corresponding to the main source of X-rays was behind the solar limb. The second source of X-rays corresponds to C_1 and C_2. (3) The X-ray sources were probably located near the footpoints of loops. (7 refs.)

121669 Spatial characteristics of microwave bursts. M.R.Kundu (Astron. Program, Univ. of Maryland, College Park, MD, USA).
Sol. Phys. (Netherlands), vol.86, no.1-2, p.205-17 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
The spatial characteristics of microwave bursts are discussed in relation to impulsive and post-burst phases. The existence of two components in the impulsive phase is discussed from the WSRT high time and spatial resolution observations. Evidence is presented for homologous flares at 6 cm. Preflare changes in microwave active regions are discussed. High spatial resolution observations of the structure of microwave flaring loops are presented. Theoretical interpretation of the confinement of microwave producing energetic electrons in the coronal part of loops is discussed. The relative timing of the peaks of impulsive hard X-ray and microwave burst is discussed. Possible diagnostics of impulsive phase onsets from cm-λ polarization data are presented. (18 refs.)

121670 Dual frequency observations of flares with the VLA. G.A.Dulk, T.S.Bastian (Dept. of Astro-Geophys., Univ. of Colorado, Boulder, CO, USA), G.J.Hurford.
Sol. Phys. (Netherlands), vol.86, no.1-2, p.219-26 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Describes observations of three flares made at 5 and 15 GHz with the VLA, two subflares near the limb on 1981 November 21 and 22, and an M7.7 flare on 1981 May 8. Even though the time histories of the November flares indicated simple impulsive bursts, the VLA observed no 5 GHz radiation at all from one flare, and from the other, the 15 GHz radiation emanated from a source which was smaller, lower and displaced from the 5 GHz source. The 1981 May 8 flare was intense and complex, having two or more sources at both 5 and 15 GHz. Prior to the peak of the flare, the sources grew in size to $>20''$ to $40''$, after which they were not visible to the VLA; only (weak) subsources could be seen. Highly polarized, bursty radiation observed at Toyokawa at 1 and 2 GHz, indicated that an electron-cyclotron maser operated during the flare. (5 refs.)

121671 Dissipative thermal models for impulsive microwave burst delays. J.C.Brown (Dept. of Astron., Univ. of Glasgow, Glasgow, Scotland).
Sol. Phys. (Netherlands), vol.86, no.1-2, p.227-30 (1983). (Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares, Tokyo, Japan, 5-8 Oct. 1982).
Microwave emission is analysed for a source heated by magnetic dissipation. As the temperature rises and the field falls, the resulting variation in microwave optical depth results in time delays between emission features at different frequencies. A single such source can, however, only explain events exhibiting small delays ($\simeq1$ sec) and with lower frequencies peaking later. Continuous production of many such heated regions (multiple kernel model) can, however, explain long delays and produce either advancement or retardation of lower frequencies. (7 refs.)

121672 Solar flares and shock waves. A.Maxwell (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Sky & Telesc. (USA), vol.66, no.4, p.285-9 (Oct. 1983).
The initial stages of flares in the solar chromosphere and lower corona were described by Kundu (1982). The author concentrates on the spectacular, large-scale phenomena that are subsequently observed in the outer corona, and also on how solar physicists have developed models that attempt to simulate these events. (no refs.)

Proceedings of the US-Japan Seminar on Recent Advances in the Understanding of Solar Flares .... See Entry 116925
Solar indices and solar UV-irradiances .... See Entry 121420
Introduction to Hinotori .... See Entry 121506

Transfer of L_α-radiation in optically thick media ....See Entry 121521

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The Sun's quadrupole moment and perihelion precession of Mercury ....See Entry 121526

96.90 OTHER TOPICS ON THE SOLAR SYSTEM

Simulation of Viking biology experiments suggests smectites not palagonites, as Martian soil analogues ....See Entry 121555

97.00 STARS

97.10 STELLAR CHARACTERISTICS

121673 The nature of the Yale common-proper motion groups of stars. P.K.Lu (College Obs., Western Connecticut State Univ., Danbury, CT, USA), W.S.Tsay.
Astron. J. (USA), vol.88, no.9, p.1367-75 (Sept. 1983).
Image-tube spectral classification and intermediate-band photometry on the DDO system were obtained for 180 southern stars from the Yale common proper motion groups. Lu (1982) presented detailed information and the rationale to show some evidence of a moving group of 94 stars. This study reports on one large group of approximately 90 stars, two intermediate groups of about 20-30 stars, and 12 smaller groups, each of a few stars. Spectroscopic and photometric analyses of these groups indicated, in their color-magnitude diagrams, a very scattered Pop I main sequence; for each of the larger groups, a small giant branch may also be present. Distance moduli of 5 mag or less were derived for these groups from the average spectroscopic parallaxes which are consistent with the amplitude of the proper motion of 0.100″/yr. The main sequence of each of these groups shows scatter when plotted in a HR diagram. This indicates that these groups are not likely to be homogeneous groups of stars with common physical origins. Kinematical studies of the groups are in progress. (20 refs.)

121674 A theoretical starspot model. K.Jahn (Warsaw Univ. Obs., Warsaw, Poland).
Acta Astron. (Poland), vol.33, no.1, p.47-77 (1983).
Presents a model of monopoloidal and axisymmetric spot with an untwisted configuration of the magnetic field. The influence of the magnetic field on the gas is described using the assumption that the magnetic field partially inhibits convective-energy transport. A series of starspot models is computed for a zero-age main sequence star of one solar mass. The models are described by three free parameters: the total magnetic flux, the effective temperature of the spot and the position of the spot bottom. The maximum value of the surface magnetic intensity has been found as a function of the effective temperature difference between the spot and undisturbed photospheres. (18 refs.)

121675 Transonic accretion flow in a thin disk around a black hole. II. B.Muchotrzeb (N. Copernicus Astron. Center, Polish Acad. of Sci., Warsaw, Poland).
Acta Astron. (Poland), vol.33, no.1, p.79-87 (1983).
For pt.I see ibid., vol.32, no.1-2, p.1-11 (1982). Models of 'alpha-disks' accreting onto a 10 $M_\odot$ black hole at different accretion rates less than or equal to a critical rate are presented and discussed. The disk is almost Keplerian at $r=100\ r_g$ and behaves smoothly in the sonic point. In the case of small a the boundary conditions assure uniqueness of the solution, with the position of the sonic point r_s between r_{mb} and r_{ms}. For larger a up to a^*, r_s approaches r_{ms}. a^* is of the order of 0.02 and weakly depends on accretion rate. Stationary solutions for $a>a^*$ do not exist. (12 refs.)

121676 Barium, magnesium and iron in seven chemically unevolved stars and the nuclear evolution of the galactic disk. W.Steenbook (Inst. fur Theoretische Phys. und Sternwarte, Univ. Kiel, Kiel, Germany).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.325-34 (Oct. 1983).
High-dispersion spectra of six chemically unevolved solar-type stars (special type F8-K2) and of the halo giant HD 122563 are investigated by differential model atmosphere analysis relative to the Sun to obtain abundances of barium, iron and magnesium. Effective temperatures inferred from red and infrared colours, and the iron ionization equilibrium are used to construct model atmospheres. The results are used to study the chemical evolution of the galaxy and stellar nucleosynthesis. (60 refs.)

121677 Programme of studying stellar kinematics in the main meridional section of the Galaxy. N.V.Kharchenko.
Astrometriya & Astrofiz. (USSR), no.49, p.61-6 (1983). In Russian.
The observational programme for 60 selected areas was compiled to determine the absolute proper motions of stars with respect to galaxies in the main meridional section of the Galaxy. The absolute proper motions of 5947 stars have been already measured in 21 selected areas. The results obtained from this catalogue showed that an increase in the accuracy of the stellar kinematics can be achieved by: 1) compiling an extended catalogue of the stellar proper motions with respect to a great number of galaxies; 2) setting up the astronomical standards of the proper motions free of the magnitude equation errors; 3) providing the photoelectric standards for the apparent stellar magnitudes. (8 refs.)

121678 Pulsations and viscosity. J.P.Cox, B.L.Everson (Joint Inst. for Lab. Astrophys., Univ. of Colorado, Boulder, CO, USA).
Astrophys. J. Suppl. Ser. (USA), vol.52, no.4, p.451-63 (Aug. 1983).
A general method for calculating the effects of viscosity and nonadiabaticity on small oscillations is presented. The method is conceptually straightforward, but complicated to apply. It is applied to spherically symmetric, purely radial motion in a spherical star; also to a 'classical' steady-state accretion disk that is isothermal in the vertical direction and that has vertical oscillations. Comparison is then made with observed dwarf novae quasi-periodic oscillations, assuming them to be disk oscillations. The observed decay time scales of these oscillations may be used to estimate the viscosity present in the accretion disk. (25 refs.)

121679 On the nature of early-type stars in the galactic halo. F.P.Keenan (Dept of Appl. Math. & Theoretical Phys., Queen's Univ. of Belfast, Belfast, N Ireland), P.L.Dufton.
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.435-45 (Oct. 1983).
Effective temperatures and surface gravities of 46 intermediate and high galactic latitude OB stars are estimated from Stromgren $|C_1|$ and Hβ photometry. In addition, helium, calcium and magnesium abundances relative to hydrogen are derived for eleven stars. The typical OB-type stellar parameters indicate that they are normal Population I stars, several of which require ejection velocities of more than 100 kms^{-1} from the plane in order to reach their present z-distances during their lifetimes. The observed correlation between peculiar velocity and mass for stars with $|z|\geq400$ pc is discussed. A plot of log N(Na I) versus $E(B-V)$ implies that the gas-to-dust ratio in the halo is probably similar to that found for material in the galactic disc. This is discussed. (73 refs.)

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The spectrum of Nova Sagittarii 1982 in the transition phase ....See Entry 121709

A multiwavelength study of the short-period cataclysmic variable V442 Ophiuchi ....See Entry 121710

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Spectroscopic binaries near the North Galactic Pole. VIII. HD 121844 ... See Entry 121733

Ultraviolet variability of HD 62001—the central star of the missing nebula V-V 1-7 ... See Entry 121734

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Optical and X-ray observations of 2S 0921−630 ... See Entry 121739

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A failed search for black dwarfs as companions to nearby states ... See Entry 121741

Spectroscopic binary orbits from photoelectric radial velocities. LII. HD 57339 ... See Entry 121742

A model of a neutrino stellar system and the upper bound of neutrino mass obtained from the rotation curves of some galaxies ... See Entry 121743

The main sequence of the globular cluster M22 ... See Entry 121744

Colour magnitude diagram for central stars of globular cluster M15 ... See Entry 121745

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Internal motions in H II regions. XII. S162 and NGC 7635 ... See Entry 121766

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97.20 NORMAL STARS (BY CLASS): GENERAL OR INDIVIDUAL

121680 Spectra of the blue CN and CH bands for a CN-enhanced giant in the open cluster IC 4651. G.H.Smith (Mount Stromlo & Siding Spring Obs., Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
Astron. J. (USA), vol.88, no.9, p.1344-8 (Sept. 1983).
Spectra are presented which indicate that the giant IC 4651 23 has enhanced λ4216 CN and λ4300 CH bands relative to other giants with similar temperatures and gravities in this open cluster. Interpretation of the DDO δ CN indices and the CH band observations with the use of model atmospheres and synthetic spectra indicates that only mild ($\lesssim$0.1 dex) [C/A] or [N/A] excesses are needed in star 23 to explain the observations. (38 refs.)

121681 Early-type high-velocity stars in the solar neighborhood. III. Radial velocities, rotation indices, and line-strength indices for southern candidates. P.B.Stetson (Carnegie Inst. of Washington, Pasadena, CA, USA).
Astron. J. (USA), vol.88, no.9, p.1349-66 (Sept. 1983).
For pt.II see ibid., vol.86, no.12 (1511), p.1882-95 (1981). Radial velocities, rotation indices, and metal-line strength indices have been derived from spectra of 124 southern early-type stars possibly having large space motions, for three optical companions to high-velocity candidates, and for 28 comparison stars. The internal repeatability of these radial velocities ranges from about 1.2 km/s per observation for sharp-lined F stars to about 10 km/s for rapidly rotating A stars; the external error of the velocities is estimated to be less than 2-3 km/s. A rough calibration of the rotation indices yields (v sin i)s with an accuracy estimated at 5-7 km/s or 15%. Radial velocities accurate to ~10 km/s are obtained for an additional 19 comparison stars, six program stars, and one companion to a program star. A list is given of 45 high-velocity candidates confirmed to be main-sequence stars of spectral types earlier than ~F1, for which radial velocities are now available. When this sample is divided into high- and low-velocity subgroups on the basis of their transverse velocities, their radial-velocity distributions are also found to be different: the radial-velocity dispersion is 57 km/s for the stars with larger transverse velocities, and 21 km/s for stars with smaller transverse velocities. This evidence strongly favors the existence of main-sequence A stars with abnormally large space motions. There appear to be several binary stars in the high-velocity sample, which will be important for determining the origin of these stars. (34 refs.)

121682 T Tauri South: a protostar?. C.Bertout (Lab. d'Astrophys. Theorique, Coll. de France, Inst. d'Astrophys., Paris, France).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.L1-4 (Oct. 1983).
Study of the radio spectrum of T Tauri South, the recently discovered companion of T Tauri, suggests that it originates from the infalling envelope surrounding a protostar of 2 to 3 solar masses, and obscured by 8 to 19 magnitudes of visual extinction. (29 refs.)

121683 Dust-driven winds. I. A two-fluid model and its numerical solution. N.Berruyer, H.Frisch (Obs. de Nice, Le Mont-Gros, Nice, France).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.269-77 (Oct. 1983).
A model of dust-driven wind relevant to red giant stars is investigated, in which the usual hypothesis of 'momentum coupling' (amounting to neglect of grain particle mass) is relaxed. The flow is described by a set of two differential equations, one for the grains and one for the gas, coupled by collisional drag. The numerical solution of this two-fluid problem requires a shooting-splitting method. (41 refs.)

121684 Four-colour uvby and Hβ photometry of A5 to G0 stars brighter than 8.3^{m}. E.H.Olsen (Copenhagen Univ. Obs., Tollose, Denmark).
Astron. & Astrophys. Suppl. Ser. (France), vol.54, no.1, p.55-134 (Oct. 1983).
A Stromgren uvby survey has been made of nearly all Henry Draper stars of types A5 to G0 and brighter than m_v=8.3^{m}. For nearly 2000 of the most metal-weak stars found and about 500 other stars of interest, additional uvby and Hβ photometry has been obtained. The photometric results are presented in a catalogue containing 27096 uvby and 7223 β measurements of 14816 stars. The purpose of the catalogue is to provide a complete, magnitude limited, kinematically unbiased, sample of late F type stars belonging to the intermediate population II. Combined with kinematical data this sample will be ideally suited to investigate the history of the Galaxy by studying the correlations between age, chemical composition and kinematics. (61 refs.)

121685 Spectrophotometric study of three F8 supergiants. A.A.Boyarchuk, M.E.Boyarchuk.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.68-88 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.66-85 (1981). [received: Oct. 1983]
High-dispersion spectrograms were used to investigate the three supergiants: α UMi, γ Cyg and ρ Cas. The method of curves of growth was used to determine the parameters of the atmosphere and chemical composition. The chemical composition of all three supergiants was found to be very close to the composition of the Sun. The exceptions are carbon whose abundance was found to be lower by a factor of four than in the Sun, and sodium for which an excess abundance was recorded. (12 refs.)

121686 Spectroscopic observations of HD 206267 and its possible identification with the X-ray source Cep X-4. T.S.Galkina.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.89-95 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.86-92 (1981). [received: Oct. 1983]
In order to verify the identification of the X-ray source Cep X-4 with the spectroscopic binary HD 206267, the author analyzed 35 spectrograms of the latter star, recorded in June-August, 1975. The spectra shows no apparent connection between HD 206267 and Cephus X-4. The spectroscopic features of HD 206267 suggest the presence of an extended envelope of nonuniform density around the primary component. The spectral types of the components are found to differ by not more than one spectral subclass and are estimated as O6f+O7. The mass ratio of the components is found to be 1.7. (10 refs.)

121687 A spectrophotometric study of the T Tauri star AS 353. V.I.Krasnobabtsev.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.96-108 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.93-103 (1981). [received: Oct. 1983]
Spectrograms of the star AS 353 were used to identify the recorded emission lines and to perform a comparative analysis of their equivalent widths and intensities. Fe II emission lines were used to determine the interstellar absorption (E_{B-V}=0.7-1.1^{m}). The spectral type of the star has been estimated (F0-G5). Physical conditions prevailing in the stellar envelope are discussed. Some of the Fe II and Ti II lines exhibit an anomalous enhancement which occurs simultaneously with the enhancement of the Hα and Hβ lines. (18 refs.)

121688 Polarimetric observation of white dwarfs. Yu.S.Efimov.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.124-47 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.118-39 (1981). [received: Oct. 1983]
A survey is given of linear polarization measurements performed on 85 white dwarfs and subdwarfs in U, B, V, O, R bands. The data were obtained with the 3.6-m Shain telescope at the Crimean Astrophysical Observatory in 1971-79. The intrinsic polarization of more than half of the object was greater by a factor of 2 than the root mean square uncertainty of the measurement. There are indications that the linear polarization was variable in the case of some of the objects (for example, GD 299, EG 191, Feige 110 and EG 159). (73 refs.)

121689 Is emission line strength a predictor of youth for Orion population stars?. Wm.B.Weaver (Monterey Inst. for Res. in Astron., Monterey, CA, USA).
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.389-93 (Oct. 1983).
Contrary to the widespread belief that emission line strength decreases with age for Orion population stars, there is no useful correlation between observed emission line strengths and theoretically derived relative ages in these objects. (8 refs.)

121690 Photometric variability of B- and A-type supergiants. J.R.Percy, D.L.Welch (David Dunlap Obs., Univ. of Toronto, Toronto, Ontario).
Publ. Astron. Soc. Pac. (USA), vol.95, no.570, p.491-505 (Aug. 1983).
Photometric observations of 16 early-type (O9 to A3) supergiants have been obtained. All but two of the stars are variable, with a range of about 0.05^{m}. The light curves are irregular, but characteristic time scales or 'quasi-periods' can be identified. The ratio of the quasi-period to the theoretical period (for pulsation in the fundamental radial mode) varies from 2-10 in the earliest-type supergiants to 0.2-2 in the later-type supergiants. The variability is most likely due to nonradial pulsation, at least in the O-B type supergiants. (24 refs.)

121691 Relativistic effects on the structure and stability of massive white dwarfs. J.M.I.Cabanell (Dept. de Mecanica y Astron., Univ. de Valencia, Valencia, Spain).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.8, no.1, p.7-17 (June 1983). In Spanish.
Obtains numerical fits for the limit mass (Newtonian), maximum gravitational mass (relativistic), and binding energy for several sequences of white dwarfs of different chemical compositions. The author calculates the value of the average adiabatic index for each model. The critical value of this index is larger than the classical value of 4/3; this implies, for example, that for carbon dwarfs the relativistic instability appears at 1.3430. This result is confirmed by the hydrodynamical calculations. (25 refs.)

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A study of ultraviolet spectra of ζ Aur/VV Cep systems. II. Mass loss of supergiants in ζ Aur, 32 Cyg and 31 Cyg ....See Entry 121724

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The AM Herculis-type binary E 1405−451 ....See Entry 121740

A failed search for black dwarfs as companions to nearby states ....See Entry 121741

Spectroscopic binary orbits from photoelectric radial velocities. LII. HD 57339 ....See Entry 121742

The main sequence of the globular cluster M22 ....See Entry 121744

Main-sequence binaries, contact binaries, and blue stragglers in globular clusters ....See Entry 121747

Notes on the open cluster NGC 1252 with the variable carbon star TW Horologh as a probable member ....See Entry 121749

Planetary nebulae with massive nuclei. I. Time-dependent photoionization models ....See Entry 121751

97.30 VARIABLE AND PECULIAR STARS

(inc. novae)

121692 Variability of Balmer lines in magnetic Ap stars. J.Madej (Warsaw Univ. Obs., Warsaw, Poland).
Acta Astron. (Poland), vol.33, no.1, p.1-46 (1983).
The existing observational data on periodic Balmer line variations in magnetic Ap stars are analysed. Among 8 magnetic stars with variable Balmer lines, 7 exhibit the strong phase correlation between the extreme equivalent widths W_λ of the Balmer lines and either the pole-on or the equator-on position of the star. Computations have shown that the electromagnetic forces can strongly affect physical structure of an atmosphere at the magnetic equation in comparison to the undisturbed magnetic poles. The emergent Balmer lines and UV continuum radiation are significantly affected by the strong Lorentz forces, and the spectral properties of the magnetic poles and magnetic equator are differentiated. Moreover, the star becomes prolate by up to 1.5% in radius. (82 refs.)

121693 Search for β Cephei stars south of declination −20°. II. Photometric and spectrographic observations of early B giants and subgiants—winter objects. C.Sterken (Astrophys. Inst., Vrije Univ., Brussel, Belgium), M.Jerzykiewicz.
Acta Astron. (Poland), vol.33, no.1, p.89-111 (1983).
For pt.I see ibid., vol.27, no.4, p.365-87 (1977). Results of the second part of a program begun in 1975 (Jerzykiewicz and Sterken 1977) are presented. Out of 39 β Cephei candidates observed photometrically, 7 turned out to vary with b ranges exceeding 0.020^m, while 21 have been found constant to within 0.010^m or better. From spectrographic observations one of the candidates, HD 129557=HR 5488 (B2 III), is found to be a β Cephei variable with a period of 0.135^d and the $2K$ amplitude of 18.4 km/s. A comparison of the results with other photometric searches for β Cephei variables shows good agreement in most cases. It is concluded that in the low temperature extension of the β Cephei region on-and-off type pulsations occur. (22 refs.)

121694 The analysis of the RR Lyrae type variable HD 176387 (MT **Tel).** A.Przybylski (Mount Stromlo & Siding Spring Obs. Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
Acta Astron. (Poland), vol.33, no.1, p.141-8 (1983).
In a coarse analysis the RR Lyrae type variable HD 176387 (MT Tel) was compared with the Hyades star HD 26462 and the old disc population star γ Vir S. It was found that HD 176387 is deficient in metals by a factor of 270 in comparison with HD 26462 and by a factor of 90 in comparison with γ Vir S. (12 refs.)

121695 Far UV radiation in cataclysmic variables. W.Wargau, H.Drechsel, J.Rahe (Dr.-Remeis-Sternwarte Bamberg, Astron. Inst. Univ. Erlangen, Erlangen, Germany).
Acta Astron. (Poland), vol.33, no.1, p.149-58 (1983).
The absolute continuum flux distributions in the far UV region of nine cataclysmic systems exhibit considerable excess radiation over the fluxes expected from steady-state optically thick accretion disk models. The UV continua can alternatively be interpreted as superposition of two blackbody sources: a hot ($0.5\text{-}2\times10^5$K) component originating from the boundary layer, and a cooler ($1\text{-}2\times10^4$K) component which is radiated by the accretion disk and/or the bright spot. (29 refs.)

121696 A Be type variation in an O star. L.Divan (Inst. d'Astrophys. de Paris, Paris, France).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.L8-10 (Oct. 1983).
BCD observations of the Oe star HD 60848 show that the parameters of the continuum are variable and that the variation of the V magnitude and of the colours as a function of D is the same as for Be stars. This result is a new indication that the Be phenomenon can occur in O stars as early as O7.5 or O8. Simultaneous observations of Hα, Paschen lines and Balmer discontinuity show that the amount of emission in the hydrogen lines varies in the same direction as the amount of emission in the Balmer continuum. (26 refs.)

121697 Phenomenological models of antiflare stars. A.F.Pugach.
Astrometriya & Astrofiz. (USSR), no.49, p.55-60 (1983). In Russian.
Four phenomenological models of antiflare stars are discussed. None of them satisfies all the observational data available, but the so-called eruptive model is the more plausible one. More observations are needed. A list of the most important observational tasks for the antiflare stars problem is given. (30 refs.)

121698 Scanner observations of the classical Cepheids RT Aur and T Vul. B.S.Rautela, S.C.Joshi (Uttar Pradesh State Obs., Naini Tal, India).
J. Astrophys. & Astron. (India), vol.4, no.1, p.1-9 (March 1983). [received: Oct. 1983]
The effective temperatures of the classical Cepheids RT Aur and T Vul have been determined by a comparison of their spectral scans with appropriate model atmospheres. The radii of the stars have been determined through the Wesselink method. Using these temperatures and the Wesselink radii, the luminosities of the stars have been determined. These radii estimates, including the radii of SU Cas and ζ Gem fit better in the theoretical period-radius relationships given by Cogan (1978), as compared to earlier determinations of Wesselink radii. The pulsation masses and evolutionary masses of the stars have been calculated. (30 refs.)

121699 Three-colour electrophotometry of DY PEG. A.N.Tomov, N.A.Tomov (Dept. of Astron., Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.6, p.709-12 (1983).
Presents photometric observations of DY Peg. The light curve is discussed for this Cepheid. (6 refs.)

121700 Nova Normae 1983. R.Peterson.
I.A.U. Circ. (USA), no.3871, 1 pp. (30 Sept. 1983).
It is reported that echelle spectrograms obtained on 1983 September 24 show that this object (see IAUC 3869) is indeed a nova. Balmer emission lines (Hα, Hβ, and Hγ), together with several additional features, are superimposed on a faint continuum. Interstellar Na I D and Ca II lines were also observed. (1 ref.)

121701 Nova Normae 1983. J.Hers.
I.A.U. Circ. (USA), no.3874, 1 pp. (4 Oct. 1983).
Reports visual magnitude estimates for the period 1983 September 26 to October 1. (no refs.)

121702 VY Sculptoris. M.S.Cropper, B.Warner.
I.A.U. Circ. (USA), no.3877, 1 pp. (7 Oct. 1983).
It is reported that in early October 1983 the novalike variable VY Sculptoris was at about magnitude 18.5; this is the first recorded low state for this star. (1 ref.)

121703 Frequency analysis of β Cephei variables in NGC 6231. L.A.Balona (South African Astron. Obs., Cape, S Africa), R.R.Shobbrook.
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.309-20 (Oct. 1983).
Photometric observations are presented for four recently discovered β Cephei variables in the very young open cluster NGC 6231. Fourier analyses of about 500 observations of each star were performed to determine the oscillation frequency spectra. Comparison with variables in NGC 3293 shows that the β Cep stars in NGC 6231 are only slightly evolved from the ZAMS, indicating that the instability strip is at least one magnitude wide. Though the periods of the β Cep stars in NGC 6231 are much shorter than those in NGC 3293, the pulsation constants are about the same. The consequences of these findings for the excitation mechanism are discussed. (26 refs.)

121704 On the evolution of accretion disc flow in cataclysmic variables. I. The prospect of a limit cycle in dwarf nova systems. J.Faulkner, D.N.C.Lin (Lick Obs., Univ. of California, Santa Cruz, CA, USA), J.Papaloizou.
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.359-75 (Oct. 1983).
Presents the basic physics of a mechanism which explains dwarf nova outburts as accretion disc instabilities. Briefly put, the strong and oppositely directed temperature dependences of opacity in hydrogen ionization regions drive a thermal instability which modulates mass transfer throughout the disc. The authors also show that the conventional thin disc treatment breaks down in cool regions, where the surface boundary condition dominates the structure. One major purpose of the paper is to modify the conventional treatment, to produce analytical approximations for many of the relationships of interest. When the results are applied to a schematic local treatment of disc flows, the prospect of a thermal limit cycle is revealed. (34 refs.)

121705 Enhanced polarization in the Ca II K line of the Be star κ Dra. D.Clarke, A.Brooks (Dept. of Astron., Univ. Obs., Glasgow, Scotland).
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.9p-13p (Oct. 1983).
Spectropolarimetric observations of κ Dra reveal an enhancement of the linear polarization at the centre of the Ca II K line in relation to the nearby continuum, this being the first report of such an effect in a Be star other than for the Balmer lines. In keeping with previous observations, no polarizational change was detected across Hβ for this star. (15 refs.)

121706 A nebula around Nova BT Monocerotis. T.R.Marsh, R.A.Wade (Inst. of Astron., Cambridge, England), J.B.Oke.
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.33p-7p (Oct. 1983).
Reports the spectroscopic discovery of nebular Hα emission around Nova BT Monocerotis. The indicated expansion distance to this system is about 1800 pc. (8 refs.)

121707 On the Cepheid luminosity zero-point from cluster Cepheids. J.A.R.Caldwell (South African Astron. Obs., Pretoria, S Africa).
Observatory (GB), vol.103, no.1056, p.244-8 (Oct. 1983).
Van den Bergh (1977), de Vaucouleurs (1978), and Martin, Warren and Feast (1979) have discussed the zero-point calibration of the period-luminosity (P-L) and period-luminosity-colour (P-L-C) relationships from cluster Cepheids. The zero-points are reevaluated by the author with new data and a slightly improved method, in connexion with new work on SMC and galactic Cepheids. The results are compared with the P-L relationship of Fernie and McGonegal (1983) and with the zero-points implied by independent methods. (30 refs.)

121708 The infrared spectrum of the peculiar star HDE 316285. P.A.Whitelock (South African Astron. Obs., Pretoria, S Africa).
Observatory (GB), vol.103, no.1056, p.255-7 (Oct. 1983).
The P-Cygni star HDE 316285 is probably a heavily reddened single star undergoing mass-loss, rather than a symbiotic system as suggested by some authors. The infrared continuum is from the Rayleigh-Jeans tail of a high-temperature source plus emission from a hot plasma. The 1.2-4.1-μm spectrum shows strong emission lines, mainly of H I and He I. (11 refs.)

121709 The spectrum of Nova Sagittarii 1982 in the transition phase. T.Iijima, L.Rosino (Astrophys. Obs., Asiago, Italy).
Publ. Astron. Soc. Pac. (USA), vol.95, no.570, p.506-8 (Aug. 1983).
Spectra of Nova Sgr 1982 have been obtained at the end of October, nearly one month after its discovery, with the one-prism spectrography equipped with a Carnegie-RCA S-20 image tube (dispersion 60 Å mm^{-y}1 at Hγ) at the Cassegrain focus of the 122-cm telescope. The spectra are characterized by wide emission lines of H, O I, N II and Fe II. They indicate that the nova was in its late transition phase. Identifications are given for the lines recorded from $\lambda\lambda$4100 to 8500. (3 refs.)

121710 A multiwavelength study of the short-period cataclysmic variable V442 Ophiuchi. P.Szkody (Dept. of Astron., Univ. of Washington, Seattle, WA, USA), A.W.Shafter.
Publ. Astron. Soc. Pac. (USA), vol.95, no.570, p.509-19 (Aug. 1983).
A detailed study of this cataclysmic variable from ultraviolet to infrared wavelengths has been accomplished. An orbital period of 202 minutes is evident from radial-velocity variations in Hα and He II λ4686. There is very active flickering in the optical light curves but no variation at the orbital period, implying a low inclination. The ultraviolet spectrum shows little line emission and less continuum variation than the optical. The infrared fluxes imply a hot, optically thick disk. The total flux distribution over all observed wavelengths is consistent with a disk with a mass accretion rate of 10^{-8} $\mathfrak{M}_\odot$

yr^{-1}. In terms of period, mass accretion rate, and He II λ4686 strength, V442 Oph is most similar to systems of the H 2252-035 type. (31 refs.)

121711 Spectral classification of select delta Scuti stars. III. R.Ortega, R.Peniche, J.H.Pena (Inst. de Astron., Univ. Nacional Autonoma de Mexico, Mexico City, Mexico), M.A.Hobart.
Rev. Mex. Astron. & Astrofis. (Mexico), vol.8, no.1, p.45-9 (June 1983).
For pt.II see Publ. Astron. Soc. Pac., vol.93, no.556, p.735-40 (1981). A spectral classification of selected delta Scuti stars has been carried out. Some of the classified stars have been recently discovered and in about half of the considered stars no previous spectral classification was reported. The absolute magnitude and $(b-y)$ color are derived from the spectral type found for each star and these values fixed their location in both the H-R diagram and the period-luminosity-color relation. (20 refs.)

The limits to the cross-section for magnetic monopole creation obtained from the persistence of the magnetic field of white dwarfs ....See Entry 121518

Pulsations and viscosity ....See Entry 121678

T Tauri South: a protostar? ....See Entry 121682

Spectrophotometric study of three F8 supergiants ....See Entry 121685

Spectroscopic observations of HD 206267 and its possible identification with the X-ray source Cep X-4 ....See Entry 121686

A spectrophotometric study of the T Tauri star AS 353 ....See Entry 121687

Is emission line strength a predictor of youth for Orion population stars? ....See Entry 121689

Photometric variability of B- and A-type supergiants ....See Entry 121690

GX 1+4 ....See Entry 121738

The AM Herculis-type binary E 1405−451 ....See Entry 121740

Notes on the open cluster NGC 1252 with the variable carbon star TW Horologh as a probable member ....See Entry 121749

Internal motions in H II regions. XII. S162 and NGC 7635 ..See Entry 121766

97.60 LATE STAGES OF STELLAR EVOLUTION

(inc. black holes)

97.60B Supernovae

121712 Supernovae. P.M.Williams, E.P.Aksenov.
I.A.U. Circ. (USA), no.3873, 1 pp. (4 Oct. 1983).
It is reported that a supernova has been discovered at $\alpha=3^h14^m57.0^5$, $\delta=+41^\circ\ 40'33''$ (equinox 1950.0), within 2″ to 3″ of the nucleus of NGC 1265. On 1983 October 1 the object was at $m_v\sim13$. A second supernova has been discovered 7″ east and 5″ south of the galaxy MCG 6-36-55 ($\alpha=16^h35.1^m$, $\delta=+36^\circ31''$, equinox 1950.0), in Hercules. This supernova was at $m_{pg}\sim16'$ on 1983 September 10. (no refs.)

121713 Supernova in IOC 1731. P.Wild.
I.A.U. Circ. (USA), no.3875, 1 pp. (5 Oct. 1983).
Reports the discovery on 1983 October 1 of a supernova at $\alpha=01^h47^m23.74^s$, $\delta=+26^\circ57'03.9''$ (equinox 1950.0), 9″ east and 10″ north of the nucleus of IC 1731. At the time of discovery the supernova was at $m_{pg}=14$. (no refs.)

121714 Supernovae. R.Evans, T.Cragg, G.Thompson.
I.A.U. Circ. (USA), no.3877, 1 pp. (7 Oct. 1983).
Reports the visual detection on 1983 October 6 of a supernova of magnitude 14.5 in NGC 1448 ($\alpha=03^h42.9^m$, $\delta=-44^\circ48'$, equinox 1950.0), in Horologium. The supernova is 30″ east and 5″ north (or possibly south) of the nucleus of the galaxy. It is also reported that the supernova in NGC 1265 reported in IAUC 3873 is in fact the same foreground star reported in January 1983 (see IAU Circ. 3769, 3770). (3 refs.)

Liquid-gas phase transition in nuclear matter ....See Entry 121525

Possible nature of the gamma-source 2CG 195+04 ....See Entry 121793

97.60G Pulsars

121715 Role of mangetic fields during the stellar collapse and origin of binary pulsars. F.Pacini (Arcetri Astrophys. Obs., Univ. of Florence, Florence, Italy).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.L11-12 (Oct. 1983).
Suggests that pulsars originate with a stellar collapse whose time scale is determined by the electromagnetic removal of angular momentum. This may explain why binary pulsars generally have weak magnetic fields and leads to the expectation of a large number of binaries among very fast, weakly magnetized neutron stars. (7 refs.)

121716 Genesis stories for the millisecond pulsar. M.A.Ruderman, J.Shaham (Dept. of Phys., Columbia Univ., New York, NY, USA).
Comments Astrophys. Comments Mod. Phys. Part C (GB), vol.10, no.1, p.15-22 (1983).
There exists a family of exceptionally high spin low magnetic field pulsars whose origin is problematic. Most spectacular and extreme is the 'millisecond pulsar' PSR 1937+214. There are now a variety of proposed geneses for its birth. These fall into several classes. (1) PSR 1937+214 was created in a single isolated explosion which left behind a neutron star spinning near its instability limit. (2) The millisecond pulsar was initially a more slowly spinning neutron star—probably a dead pulsar—in a tight binary. Accretion from its companion spun it up to a fast active pulsar. (3) The pulsar was originally a white dwarf accreting from a binary companion. When its Chandrasekhar limit was exceeded the spinning dwarf collapsed and there was a passover to a neutron star whose amplified spin reached the maximum possible one. (4) The millisecond pulsar came from two old neutron stars bound into a tight binary who ultimately fused into a single neutron star revolving as a superfast low field reborn pulsar. The advantages and disadvantages of each model are discussed. (16 refs.)

121717 The 1.5 millisecond pulsar. D.C.Backer (Radio Astron. Lab., Univ. of California, Berkeley, CA, USA).
Comments Astrophys. Comments Mod. Phys. Part C (GB), vol.10, no.1, p.23-6 (1983).
The discovery of the 1.5 millisecond pulsar is discussed. The emission and rotational energy is considered, in conjunction with evolutionary models. (5 refs.)

121718 Expected high-frequency radiation from the 1.5-ms pulsar. V.V.Usov (Space Res. Inst., Acad. of Sci., Moscow, USSR).
Nature (GB), vol.305, no.5933, p.409-10 (29 Sept. 1983).
The 1.5-ms pulsar PSR 1937+214 has so far been observed only in the radio range, and X-ray and γ-ray observations at energies of between ~30 and 1000 MeV have yielded only upper limits for the radiation flux. An optical identification of the 1.5-ms pulsar has been proposed, but this identification cannot yet be considered definite. Thus it is of great interest to determine in which spectral region PSR 1937+214 shows a radiation maximum. The author considers how the current pulsar theory answers this question, and shows that the 1.5-ms pulsar should be an intense source of γ quanta with an energy of $\sim10^{11}$ eV below which γ rays freely leave its magnetosphere. The flux of superhard γ quanta emitted by this pulsar may exceed, by an order of magnitude, the flux from the pulsar in the Crab Nebula. (14 refs.)

121719 The melodious pulsar.
Sky & Telesc. (USA), vol.66, no.4, p.311-13 (Oct. 1983).
Discusses the discovery of the millisecond pulsar. The observations, possible evolution and various models are discussed. (no refs.)

Possible nature of the gamma-source 2CG 195+04 ....See Entry 121793

97.60L Black holes

Transonic accretion flow in a thin disk around a black hole. II ....See Entry 121675

The influence of quantum effects on the space-time structure in the neighbourhood of singularities in the general theory of relativity ....See Entry 121796

97.80 BINARY AND MULTIPLE STARS

(inc. extrasolar planetary systems)

121720 Computer simulations of gravitational encounters between pairs of binary star systems. J.B.Hoffer (Dept. of Phys. & Astron., Michigan State Univ., MI, USA).
Astron. J. (USA), vol.88, no.9, p.1420-34 (Sept. 1983).
Encounters (collisions) between pairs of binary stars were computer simulated. The 41564 gravitational collisions were divided into five mass families and all binaries initially had circular orbits. The exchanged energy cross section for collisions between two binaries composed of identical mass stars as found to be roughly 2-3 times that for a single star colliding with a binary having components with masses equal to that of the single star. Other results cannot be stated so easily, but the energy released by hard (low-energy) binary collisions appears to be significant. A surprising result is that roughly 40% of the head-on binary-binary collisions in a globular cluster core (where most of the collisions are hard ones) precipitate a physical collision between two stars, possibly leading to their coalescence. (14 refs.)

121721 Photomeric elements of the eclipsing binary HP Aur. G.Giuricin, F.Mardirossian, M.Mezzetti (Osservatorio Astron. di Trieste, Trieste, Italy).
Acta Astron. (Poland), vol.33, no.1, p.159-62 (1983).
Using Wood's (1972) model the authors have analyzed Meinunger's (1980) V and V photoelectric light curves of the eclipsing binary HP Aur. Photometric elements have been obtained. The G0 primary turns out to be larger than its cooler and fainter companion, which appears to be a late G-type dwarf. Estimates of the fundamental elements of HP Aur, based on plausible assumptions about its masses, reveal that this binary is a normal main sequence detached system; both components appear to follow fairly well the empirical mass-luminosity and mass-radius relations typical of main sequence stars. (10 refs.)

121722 On the classification of the eclipsing system V548 Cygni, a sd-d candidate. G.Russo, L.Milano (Capodimonte Astron. Obs., Naples, Italy).
Acta Astron. (Poland), vol.33, no.1, p.163-70 (1983).
Using the Wilson-Devinney approach, the authors have obtained a new solution of Ertan's (1981) photoelectric observations of V548 Cygni, an eclipsing binary suspected to be a sd-d candidate. The solution gives a secondary component in contact with its lobe; the computation of the absolute elements, based on the photometric mass ratio and on the spectroscopically determined mass function $f(m)=0.0544\ M_\odot$, gives a configuration typical of mass exchanging Algols. The usefulness of Roche-model-based methods for such doubtful systems is emphasized. (20 refs.)

121723 Mg II profile variations of Zeta Aurigae. I.A.Ahmad (Imad-ad-Dean Inc., Bethesda, MD, USA), R.D.Chapman, Y.Kondo.
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.L5-7 (Oct. 1983).
Observes variations in the Mg II 2800 A doublet of zeta Aurigae. The Mg II profiles deviate from simple P-Cygni profiles in that they exhibit an absorption feature consistent with Chapman's (1981) interpretation of C IV absorption as evidence of a column of accretion onto the B star component of the binary. The authors find the opening angle of the shock cone containing the accretion column to exceed 16° implying a stellar wind velocity of approximately 67 km s^{-1}, unless the H II region temperature is unusually high. The turbulence velocity of the wind then appears to be about 33 km s^{-1}. (11 refs.)

121724 A study of ultraviolet spectra of ζ Aur/VV Cep systems. II. Mass loss of supergiants in ζ Aur, 32 Cyg and 31 Cyg. A.Che, K.Hempe, D.Reimers (Hamburger Sternwarte, Univ. Hamburg, Hamburg, Germany).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.225-39 (Oct. 1983).
For pt.I see ibid., vol.115, no.1, p.133-7 (1982). Describes a method for the determination of mass loss rates or red giants in spectroscopic eclipsing binaries. A non-spherical, three-dimensional line transfer code is applied to investigate the wind and mass loss of the K supergiants in ζ Aur, 32 Cyg and 31 Cyg. The authors compare theoretical line profiles with IUE observations of Fe II, Si II and S II resonance lines at various binary phases. In a first approximation no detectable asymmetry in the K giant wind envelope was observed. There is some uncertainty in the mass loss rate for 31 Cyg due to the extended H II region aground the hot B star. (39 refs.)

121725 *UBV* photometry of the optical candidate for LMC X-3. M.van der Klis, S.Tjemkes, J.van Paradijs (Astron. Inst. 'Anton Pannekoek', Univ. of Amsterdam, Amsterdam, Netherlands).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.265-8 (Oct. 1983).
Results are reported of two weeks of optical photometry of the optical counterpart of LMC X-3 obtained in December 1981 When folded modulo the 1.7 d period recently proposed for this system on the basis of radial velocity measurements, the data show a brightness minimum near the inferior conjunction of the X-ray source. Combining the data with photometry obtained in 1974, the authors find long-term brightness variations over a range of up to 0.5 mag. Removing these, the authors find a double-wave orbital light curve with an amplitude of ~0.2 mag. The authors determine a mean period for the interval 1974-81 and show that the observed light curve may be dominated by ellipsoidal variations, and that an additional light source, presumably an accretion disk, is likely to be present in the system. (20 refs.)

121726 Micrometer measurements of visual binaries. P.J.Morel (Nice Obs., Nice, France).
Astron. & Astrophys. Suppl. Ser. (France), vol.54, no.1, p.39-46 (Oct. 1983).
Presents 376 micrometer measurements of 116 visual binaries made at the Nice Observatory in 1980-3. (3 refs.)

121727 Four-colour photometry of eclipsing binaries. XVI. Light curves of VV Pyxidis. J.V.Clausen, B.Nordstrom (Copenhagen Univ. Obs., Tollose, Denmark).
Astron. & Astrophys. Suppl. Ser. (France), vol.54, no.1, p.149-59 (Oct. 1983).
For pt.XV B see ibid., vol.52, no.2, p.323-31 (1983). *uvby* light curves of the detached early A-type eclipsing binary VV pyxidis are presented. A detailed analysis based on the light curves and on new radial velocity curves is published separately. (2 refs.)

121728 Four-colour photometry of eclipsing binaries. XVII. Light curves of DM Virginis. J.Andersen, J.V.Clausen, B.Nordstrom (Copenhagen Univ. Obs., Tollose, Denmark).
Astron. & Astrophys. Suppl. Ser. (France), vol.54, no.1, p.161-6 (Oct. 1983).
For pt. XVI see ibid., vol.54, no.1, p.149-59 (1983). *uvby* light curves (687 points in each colour) of the well-detached F-type eclipsing binary DM Vir are presented. A detailed analysis based on these light curves and the double-lined spectroscopic orbits by Popper (1971) is published separately. (2 refs.)

121729 Contribution to the study of F, G, K, M binaries. II. Orbital elements of the single-lined spectroscopic binaries HD 69148 and HD 85091. J.M.Carquillat, R.Nadal, N.Ginestet, A.Pedoussaut (Obs. du Pic-du-Midi et de Toulouse, Toulouse, France).
Astron. & Astrophys. Suppl. Ser. (France), vol.54, no.1, p.187-90 (Oct. 1983). In French.
The spectroscopic binaries HD 69148 and HD 85091 were observed at the Observatoire de Haute-Provence in order to determine their spectrographic orbits. The orbital elements are tabulated. Estimations of the spectral types of the secondaries and of the semi-major axis, deduced from the values of $f(m)$ and a sin i, and of the spectral types of the primaries (G8 III and dGF0 respectively), indicate that both systems are detached. (9 refs.)

121730 A uvby, β photometric survey of southern hemisphere eclipsing binary stars. G.W.Wolf, J.T.Kern (Dept. of Phys. & Astron., Southwest Missouri State Univ., Springfield, MO, USA).
Astrophys. J. Suppl. Ser. (USA), vol.52, no.4, p.429-41 (Aug. 1983).
A uvby, β photometric study of southern hemisphere eclipsing binary stars has been undertaken at Cerro Tololo Inter-American Observatory. The standardized colors and V magnitudes for 288 binaries at quadrature and/or at minimum are presented, along with an indication of the accuracy of the standardisation and photometry. Discussions of the resolving time of the pulse-counting photometers and of the atmospheric extinction at CTIO are included. (9 refs.)

121731 Reflection effect in close binaries. II. Distribution of emergent radiation from the irradiated component along the line of sight. A.Peraiah (Indian Inst. of Astrophys., Bangalore, India).
J. Astrophys. & Astron. (India), vol.4, no.1, p.11-17 (March 1983). [received: Oct. 1983]
For pt.I see ibid., vol.3, no.4, p.485 (1982). Calculates the effects of irradiation from a point source observed at infinity. Plane-parallel approximation and spherically-symmetric approximations are employed in calculating the self-radiation field for the sake of comparison. It is found that there are considerable changes in the radiation received at infinity between the approximation of plane-parallel stratification and spherical symmetry. (3 refs.)

121732 Spectroscopic binaries near the North Galactic Pole. VII. HD 107742. R.F.Griffin (Obs., Univ. of Cambridge, Cambridge, England).
J. Astrophys. & Astron. (India), vol.4, no.1, p.19-21 (March 1983). [received: Oct. 1983]
Photoelectric radial-velocity measurements show that HD 107742 is a spectroscopic binary with a period of 875 days and a small (but definitely nonzero) eccentricity. The star is not a member of the Coma Cluster, against which it is seen projected. (6 refs.)

121733 Spectroscopic binaries near the North Galactic Pole. VIII. HD 121844. R.F.Griffin (Obs., Univ. of Cambridge, Cambridge, England).
J. Astrophys. & Astron. (India), vol.4, no.1, p.23-6 (March 1983). [received: Oct. 1983]
For pt.VII see ibid., vol.4, no.1, p.19-21 (1983). Photoelectric radial-velocity measurements show that HD 121844 is a spectroscopic binary with a period of 303 days, a high eccentricity (0.49) and a high negative γ-velocity (-61 km s^{-1}). (5 refs.)

121734 Ultraviolet variability of HD 62001—the central star of the missing nebula V-V 1-7. N.Kameswara Rao (Indian Inst. of Astrophys., Bangalore, India), D.P.Gilra.
J. Astrophys. & Astron. (India), vol.4, no.1, p.59-63 (March 1983). [received: Oct. 1983]
IUE observations of HD 62001 do not confirm the UV variability of 0.15 mag seen from the ANS observations. These intriguing variations in ANS observations seem to be caused by a nearby (~70 arcsec away) B star getting in and out of the field of view of the telescope, which had a jitter of 20 arcsec. There seems to be no evidence for the presence of a hot companion, either from the energy distribution or from UV variability. However, visual light variations are present. This, coupled with the radial velocity variations, indicates a binary nature probably of Algol type. (10 refs.)

121735 Absolute spectrophotometry of υ Sgr. V.I.Burnashev.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.109-23 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.104-17 (1981). [received: Oct. 1983]
Data obtained by absolute spectrophotometry and narrow-band photometry of the close binary υ Sgr are discussed. The data were obtained in 1973-78 in the spectral range 3200-7350 Å. The observed energy distribution in the spectrum has been compared with the Klinglesmith (1971) and Nariai (1963) model calculations. The estimated interstellar absorption is $A_V=0.75\text{-}1._2{}^m$. The spectral type of the invisible companion is estimated as O9 V. Irregular variations in light and color, amounting to a few percent, were recorded on a number of days. The overall level of Hα emission was found to remain approximately constant throughout the orbital period. (23 refs.)

121736 10^{12} eV radiation from the X-ray source Cyg X-3 observed at Tien Shan in 1977 and 1978. Dzh.B.Mukanov.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.161-5 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.151-6 (1981). [received: Oct. 1983]
A description is given of the system used at the Tien Shan station to record Cerenkov pulses due to extensive atmospheric showers. Observations of the X-ray source Cyg X-3, made during 1977-78, are presented. They show that the gamma-ray flux from this object has a periodic component. In 1977, the flux in the phase range 0.130-0.185 of the 4.8-hr component was (4.0 ± 1.0)% of the cosmic-ray background. In 1978, the flux corrected for the Doppler effect in the phase range 0.157-0.212 was (4.29 ± 2.72)% of the cosmic-ray background and the corresponding figure for the phase interval 0.768-0.823 was (3.6 ± 1.81)%. (11 refs.)

121737 A possible variation in the 4.8-hr period of Cyg X-3. Yu.I.Neshpor, Lu.L.Zyskin.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.166-9 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.157-60 (1981). [received: Oct. 1983]
An analysis is presented of measurements of the flux of gamma rays with energy $E\geq2\times10^{12}$ eV from Cyg X-3 for 1972-78. The measurements were made at the Crimean Astrophysical Observatory. It is shown that the period of ~4.8 hr appears to vary with time at a rate in the range -0.3×10^{-9} $s.s^{-1}<\dot{P}<2.5\times10^{-9}$ $s.s^{-1}$. (5 refs.)

121738 GX 1+4. R.Hall, J.Davelaar.
I.A.U. Circ. (USA), no.3872, 1 pp. (30 Sept. 1983).
It is reported that an observation by EXOSAT on 1983 September 24 to 25 failed to detect the X-ray pulsator GX 1+4; the upper limit to the observed flux was about 4 ufu. The occurrence of this low X-ray state indicates that large changes have occurred in the mass transfer from the M6 III star to the neutron/star companion. The optical counterpart has V=18.9, J=10.4 and shows symbiotic characteristics with very high ionisation lines (Fe X); its position is $\alpha=17^h28^m57.89^s$, $\delta=-24°42'34.9''$ (equinox 1950.0). (1 ref.)

121739 Optical and X-ray observations of 2S 0921−630. G.Branduardi-Raymont, R.H.D.Corbet, K.O.Mason, A.N.Parmar (Mullard Space Sci. Lab., Dorking, England), P.G.Murdin, N.E.White.
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.403-16 (Oct. 1983).
Reports photometric and spectroscopic measurements of 2S 0921−630 covering the years 1975-82. The radial velocity data confirm the 9-day period previously suggested for the system and exclude alternative periods of 17.9 and 7.7 days. The ephemeris for the time of maximum radial velocity of the base of the He II 4686 Å line is JD $2444293.1\pm0.6+N\times8.990\pm0.015$ dyas. There is no well-defined or stable eclipse of the B-band light. However, dips of up to one magnitude and lasting less than a tenth of a cycle are seen preferentially in the phase region 0.0 to 0.3. The authors also present the first X-ray spectrum of 2S 09214−630. The best fit parameters for a thermal bremsstrahlung model are $kT=13.4\pm0.5$ keV with an absorbing column density of $(5.7\pm1.0)\times10^{21}$ H atoms cm^{-2}. (13 refs.)

121740 The AM Herculis-type binary E 1405−451. J.Bailey (Anglo-Australian Obs., Epping, Australia), D.J.Axon, J.H.Hough, D.J.Watts, A.B.Giles, J.G.Greenhill.
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.1p-7p (Oct. 1983).
Reports photometry and polarimetry of the AM Her-type binary E 1405−451. For the first time circular polarization has been detected in such an object at wavelengths longer than 1 μm. The light curves and polarization curves at J and H show a minimum centred on the optical minimum but very much narrower. At H significant polarization is only observed for a short period on either side of the minimum. The observations are in good agreement with the predictions of cyclotron models. The form of the polarization curve indicates that the accretion column is always in the hemisphere of the white dwarf towards us, and that the field becomes almost parallel to the line-of-sight at the phase of the minimum. (11 refs.)

121741 A failed search for black dwarfs as companions to nearby states. R.F.Jameson, M.R.sherrington (Astron. Dept., Univ. of Leicester, Leicester, England), A.B.Giles.
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.39p-41p (Oct. 1983).
Reports a search for black dwarfs (objects of mass $0.08-0.001$ $M_\odot$) as companions to nearby stars. Areas around 21 nearby stars were scanned but no black dwarfs were found. (3 refs.)

121742 Spectroscopic binary orbits from photoelectric radial velocities. LII. HD 57339. R.F.Griffin (Cambridge Obs., Cambridge, England).
Observatory (GB), vol.103, no.1056, p.252-4 (Oct. 1983).
HD 57339 is an eighth-magnitude star in the southeastern part of Gemini. It has been measured in 17 consecutive years, and rather more than two cycles of its orbit have been witnessed. The total number of observations is 55. An orbital solution is presented. (8 refs.)

The limits to the cross-section for magnetic monopole creation obtained from the persistence of the magnetic field of white dwarfs .... See Entry 121518

Propagation of high frequency waves in strongly magnetized plasmas. Mode ambiguities due to vacuum polarization .... See Entry 121519

Pulsations and viscosity .... See Entry 121678

Spectroscopic observations of HD 206267 and its possible identification with the X-ray source Cep X-4 .... See Entry 121686

Far UV radiation in cataclysmic variables .... See Entry 121695

VY Sculptoris .... See Entry 121702

On the evolution of accretion disc flow in cataclysmic variables. I. The prospect of a limit cycle in dwarf nova systems .... See Entry 121704

A nebula around Nova BT Monocerotis .... See Entry 121706

A multiwavelength study of the short-period cataclysmic variable V442 Ophiuchi .... See Entry 121710

Role of mangetic fields during the stellar collapse and origin of binary pulsars .... See Entry 121715

Genesis stories for the millisecond pulsar .... See Entry 121716

Main-sequence binaries, contact binaries, and blue stragglers in globular clusters .... See Entry 121747

High-sensitivity observations of HD 44179: the Red Rectangle .... See Entry 121764

97.90 OTHER TOPICS IN STELLAR ASTRONOMY

121743 A model of a neutrino stellar system and the upper bound of neutrino mass obtained from the rotation curves of some galaxies. Ching Cheng-rui, Ho Tso-hsiu, Zhang Yuan-zhong (Inst. of Theoretical Phys., Acad. Sinica, Peking, China).
Commun. Theor. Phys. (China), vol.2, no.3, p.1145-51 (1983).
The authors discuss a stellar model of degenerate massive neutrinos with a core made of heavy matter. The dimensions of the core much smaller than the scale of a neutrino star. The Oppenheimer-Volkoff equation is solved for such a system. The calculation shows that under certain conditions, this neutrino halo will resemble a pure neutrino star. They have obtained inside the neutrino star (or halo) the rotation curve and the gravitational red shifts. It is interesting to note that the relative rotation velocity v(r) depends only on the relative coordinate $\xi\equiv r/R$ in the nonrelativistic cases. Therefore, all nonrelativistically degenerate neutrino systems will have a universal relative rotation curve. Within the accuracy of numerical calculation, the authors have also obtained a relation connecting the maximum velocity V_m and the corresponding coordinate R_m as $V_mR_m{}^2=0.231$. By comparing this relation with the observed rotation data at large distances for some galaxies, they have obtained an upper bound for neutrino mass of about 6-9 eV. (16 refs.)

Survey of the Astrographic Catalogue from 1 to 31 degrees of northern declination .... See Entry 121549

Aphelion clustering of 'new' comets: star tracks through Oort's cloud .... See Entry 121610

Photoelectric comparison sequences in the fields of four BL Lacertae objects .... See Entry 121771

Broad emission lines of QSOs are consistent with rotating supermassive stars .... See Entry 121791

98.00 STELLAR SYSTEMS; GALACTIC AND EXTRAGALACTIC OBJECTS AND SYSTEMS; THE UNIVERSE

98.20 STELLAR CLUSTERS AND ASSOCIATIONS

121744 The main sequence of the globular cluster M22. G.Alcaino, W.Liller (Inst. Isaac Newton, Ministerio de Educacion de Chile, Santiago, Chile).
Astron. J. (USA), vol.88, no.9, p.1330-43 (Sept. 1983).
The authors present photographic photometry for 545 stars in the conspicuous metal-poor globular cluster M22 (NGC 6656). The Pickering-Racine wedge was used with the CTIO 1-m Yale telescope and the ESO 3.6-m telescope to extend the photoelectric limit from $V\sim16.2$ to $V\sim18.9$. For the main-sequence turnoff, they have determined its position to lie at $V=17.5\pm0.2$ (m.e.) and $B\text{-}V=0.66\pm0.03$ (m.e.). From these values, the authors calculate the intrinsic values $M_V=4.00$ and $(B-V)_0=0.34$. For the cluster as a whole, they derive a distance modulus $(m\text{-}M)_V=13.50\pm0.15$ and reddening $E(B\text{-}V)=0.32\pm0.03$. Using the models of Iben and Rood (1970) and the isochrones of Ciardullo and Demarque (1977) and VandenBerg (1983), the authors deduce an age of 14.5 ± 4 Gys. The uncertainty in the age, larger than normal, arises from the difficulty of evaluating the reddening to the cluster and to the spread in (or uncertainty of) the value of [Fe/H]. (61 refs.)

121745 Colour magnitude diagram for central stars of globular cluster M15. N.M.Spassova (Dept. of Astron., Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.6, p.705-7 (1983).
BV photometry of all stars brighter than $V=14.90$ and located in a region of $12''\leq R\leq0.5'$ around the cluster centre is derived. In the cluster's investigated area, 143 cluster members, 4 probable members, 6 field and 54 stars without known proper motions are measured. A colour magnitude diagram for the central stars of M15 is presented and discussed. (9 refs.)

121746 Globular clusters and galaxy formation. S.Van Den Bergh (Dominion Astrophys. Obs., Herzberg Inst. of Astrophys., Victoria, British Columbia, Canada).
Comments Astrophys. Comments Mod. Phys. Part C (GB), vol.10, no.1, p.27-31 (1983).
Real differences exist between the specific globular cluster frequencies S observed in different galaxies. In E and SO galaxies these frequencies are found to be an order of magnitude higher than they are in spirals. Among elliptical galaxies and lenticulars there is no correlation between S and luminosity, but some indication of a dependence on cluster environment. Central galaxies in rich clusters appear to be particularly rich in globulars. Possible implications of this result for theories of galaxy and cluster formation are discussed. (18 refs.)

121747 Main-sequence binaries, contact binaries, and blue stragglers in globular clusters. J.H.Krolik (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Nature (GB), vol.305, no.5934, p.506-8 (6 Oct. 1983).
Tidal capture should be effective in creating close binaries comprising two-main-sequence stars. Subsequent evolution of such binaries is very likely to lead to mass exchange between the two, and possible merger. In conventional calculations, gravitational radiation drives the binary orbital evolution; recently, it has been shown that in the denser globular clusters, where tidal capture is most effective, gravitational encounters with passing field stars also have an important role, both by slow, cumulative compression of the binary orbit, and by occasional catastrophic physical collisions. On the basis of these mechanisms, the present author predicts that globular clusters should contain substantial numbers of: close binaries; low-mass contact binaries; and 'blue stragglers', stars lying on the extrapolated main sequence beyond the turn-off. These objects should be most common in the densest regions of the Galaxy's globular cluster system. (35 refs.)

121748 Integrated magnitudes and colors of clusters in the Magellanic Clouds and Fornax system. K.C.Gordon, G.E.Kron (Pinecrest Obs., Flagstaff, AZ, USA).
Publ. Astron. Soc. Pac. (USA), vol.95, no.570, p.461-73 (Aug. 1983).
Integrated magnitudes and colors and multiaperture observations are presented for 38 SMC clusters, NGC 1841. 16 LMC clusters, and four in the Fornax system. The data from *PV*, six-color, and four-color observations are reduced to the *BV* system. Total magnitudes and brightness distributions are computed for 33 clusters by fitting all available measures to V to King's theoretical profiles. (47 refs.)

121749 Notes on the open cluster NGC 1252 with the variable carbon star TW Horologh as a probable member. R.Bouchet (European Southern Obs., Santiago, Chile), P.S.The.
Publ. Astron. Soc. Pac. (USA), vol.95, no.570, p.474-9 (Aug. 1983).
UBV photometry indicates 14 probable members of the open cluster NGC 1252. It is a cluster of age $\sim0.5\times10^9$ yr, located at a distance of ~470 pc. The N-type semiregular variable TW Hor (=HD 20234) is most probably a member of NGC 1252. From its $M_{\text{bol}}=-5.21^{\text{m}}$ and its space velocity it is argued that this variable carbon star belongs to the young disk population. (19 refs.)

Automated photographic photometry of stars in globular clusters .... See Entry 121542

Spectral evolution of galaxies. II. An atlas of IUE spectra of late type stars and nearby early type stellar systems .... See Entry 121553

Spectra of the blue CN and CH bands for a CN-enhanced giant in the open cluster IC 4651 .... See Entry 121680

On the Cepheid luminosity zero-point from cluster Cepheids .... See Entry 121707

98.40 INTERSTELLAR MATTER; AND NEBULAE

121750 Size distributions of H II regions in galaxies. I. Irregular galaxies. P.W.Hodge (Astron. Dept., Univ. of Washington, Seattle, WA, USA).
Astron. J. (USA), vol.88, no.9, p.1323-9 (Sept. 1983).
The size distributions for the H II regions of 18 irregular and related galaxies are determined from Hα plates. Almost without exception the integral diameter distribution fits an exponential law of the form previously deduced by van den Bergh (1981). The slopes are not correlated with observational or instrumental parameters, and are thus intrinsic to the galaxies. They show a strong correlation with galaxy luminosity in the sense that the less luminous galaxies have the steeper slopes. Six galaxies in the sample have significantly anomalous largest H II regions, a fact that suggests that giant H II regions are a separate class of objects that are formed by a different mechanism from that normally governing H II region sizes. (20 refs.)

121751 Planetary nebulae with massive nuclei. I. Time-dependent photoionization models. R.Tylenda (Lab. of Astrophys., Copernicus Astron. Center, Torun, Poland).
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.299-306 (Oct. 1983).
Massive nuclei ($M\gtrsim1$ $M_\odot$) of planetary nebulae evolve on a time scale comparable to the recombination time in a typical planetary nebula. The ionization and thermal structure of such a nebula can be far equilibrium conditions. Time-dependent photoionization models of planetary nebulae with a 1.2 $M_\odot$ nucleus are constructed. Initially, when the central star is luminous, a nebula is quickly ionized by an intense flux of ionizing photons (photoionization epoch). After the nuclear fuel has been exhausted the luminosity of the stars is dropping. The reduced flux of ionizing radiation can maintain ionization in the innermost layers of the nebula. The outer nebular regions are now recombining and cooling off (recombination epoch). The recombination epoch is usually much longer than the photoionization epoch. Time-dependent effects are observed during the recombination epoch. (11 refs.)

121752 VLA synthesis of H I absorption toward Sgr A. H.S.Liszt (Nat. Radio Astron. Obs., Charlottesville, VA, USA), J.M.van der Hulst, W.B.Burton, M.P.Ondrechen.
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.341-51 (Oct. 1983).
Synthesizes H I absorption against Sgr A using the VLA with 12″ angular resolution and 6 km s^{-1} velocity resolution over the range -300 km $s^{-1}\lesssim250$ km s^{-1}. To support the analysis of these observations the authors have also observed ^{12}CO emission on a 45″ grid near Sgr A using the 36-foot NRAO telescope on Kitt Peak. H I absorption features are found at all velocities in the range -200 km $s^{-1}\lesssim v\lesssim140$ km s^{-1} lies exclusively beyond the Sgr A continuum, because at other velocities the H I optical depth and ^{12}CO brightness temperature peaks coincide. Gas at 40-60 km s^{-1} absorbs against the compact source, indicating that both the East and West continuum components lie behind this gas. (29 refs.)

121753 Cooling of primeval gas by molecular hydrogen. Yu.I.Izotov.
Astrometriya & Astrofiz. (USSR), no.49, p.48-55 (1983). In Russian.
Calculations are made for the gas cooling rate by molecular hydrogen $\Lambda_{H(2)}$ at $T=10^2\text{-}10^4$K and particle concentration $n=1\text{-}10^7$ cm^{-3}. The gas is supposed to consist of atomic hydrogen only with a small admixture of H_2 molecules. It is shown that under conditions of rarefied primeval gas, $\Lambda_{H(2)}$ is considerably smaller than the cooling rate corresponding to the Boltzmann distribution of H_2 molecules on rotational and vibrational levels. The Boltzmann distribution is set in for rotational and vibrational levels at $n\geq10^5\text{-}10^6$ cm^{-3} and $n\geq10^7$ cm^{-3} respectively. (18 refs.)

121754 Helium atoms in the interstellar and interplanetary medium. I. Observations of scattered ultraviolet emission in H I (1216 Å) and H I (584 Å) lines from the Prognoz-5 and Prognoz-6 satellites. M.S.Burgin, V.G.Kurt, E.N.Mironova, V.I.Prokhorenko, N.A.Eismont, J.L.Bertaux, F.Dalaudier.
Cosmic Res. (USA), vol.21, no.1, p.72-82 (Jan.-Feb. 1983). Translation of: *Kosm. Issled. (USSR)*, vol.21, no.1, p.83-94 (Jan.-Feb. 1983). [received: Sept. 1983]
The technique and the results of observations in the joint Soviet-French experiment on the measurement of scattered ultraviolet emission in the interplanetary medium in the lines of H I (1216 Å) and He I (584 Å) are described. A four-channel photometer was mounted in the two high-apogee satellites Prognoz 5 and Prognoz 6. Scanning was accomplished by the rotation of the satellites about an axis directed toward the Sun. A cell with hydrogen was mounted in the H I L_α channel to measure the L_α line width. All the parameters related to the motion of the Sun in the interstellar medium were determined. (12 refs.)

121755 The origin of the Gum Nebula. F.C.Bruhweiler (Dept. of Phys., Catholic Univ. of America, Washington, DC, USA), M.Kafatos, J.C.Brandt.
Comments Astrophys. Comments Mod. Phys. Part C (GB), vol.10, no.1, p.1-14 (1983).
The Gum Nebula, with a diameter of at least 36° as delineated by H-alpha filaments, is one of the largest structures in angular extent in the sky. Placing the center of the Gum Nebula at 400 pc yields a radius of 125 pc for the arcuate structure. Juxtapositioned upon it is the Vela supernova remnant, presumably from a recent supernoval event occurring less than 20000 years ago. For the origin of the nebula, the authors identify four basic models. The authors present a critical overview of the recent work dealing directly or indirectly with the Gum Nebula. In so doing they focus their efforts on work since the 1971· Goddard conference, the last formal organized meeting to study the Gum nebula. (51 refs.)

121756 Gamma-ray line features from the Crab Nebula in the energy range 5-2000 keV. C.A.Ayre, P.N.Bhat, Y.Q.Ma, R.M.Myers, M.G.Thompson (Dept. of Phys., Univ. of Durham, Durham, England).
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.285-95 (Oct. 1983).
Results are presented of an experiment to search for γ-ray lines from the Crab Nebula region in the energy range 50-2000 keV using a cooled intrinsic germanium detector in a sodium iodide anti-coincidence shield. Some evidence for line features is observed at 404.4 and 1049.6 keV with intensities at the top of the atmosphere of $(7.2\pm2.1)\times10^{-3}$ and $(1.9\pm0.4)\times10^{-2}$ photons cm^{-2} s^{-1} respectively. A line at 78.9 keV has also been detected which shows some variability with time. (17 refs.)

121757 OH maser emission at 4765 MHz in W3. F.F.Gardner, J.B.Whiteoak (Div. of Radiophys., CSIRO, Epping, Australia), P.Palmer.
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.297-302 (Oct. 1983).
VLA observations of 4765-MHz OH masers have been made towards W3(OH) and W3 (cont.) with a resolution of 1.3 arcsec. For W3(OH) the maser emission centres are in four groups located within a region of size arcsec (10^{-2} pc) superimposed on the western side of the continuum distribution. The positions do not correspond with those of the 1.6-GHz OH masers which are considerably more distributed in declination. For W3 (cont.) the maser is located within 2 arcsec of IRS 5, the infrared source which has no detectable radio continuum but is the brightest pre-main-sequence object known at 20 μm. The peak maser gain for W3(OH) is $\sim10^2$ and for W_3

(cont.) $>10^4$. The latter laser varies with time, which is consistent with its higher maser gain. (17 refs.)

121758 Soft X-rays from very young supernova remnants. N.M.Berman, F.D.Kahn (Dept. of Astron., Univ. of Manchester, Manchester, England).
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.303-8 (Oct. 1983).
A dynamical model of the very early evolution of a supernova remnant suggests that copious emission of X-rays will occur in the first 10 years. The radiation is largely in spectral lines in the range from 20 to 50 Å and will be most easily observable towards the end of the first decade. The effect should be detectable, using state-of-the-art instruments, in any supernova occurring within 23 Mpc. (8 refs.)

121759 Time-dependence chemistry. I. Modelling of a static cloud. G.D.Watt (Math. Dept., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.321-35 (Oct. 1983).
A computer program is developed to study the chemical evolution in interstellar clouds. This time-dependent treatment allows both the gas kinetic temperature and the total particle density to be rapidly varying functions of time. Such modelling would be appropriate for hot post-shock gas, circumstellar material around cool stars and expanding or collapsing clouds. The author describes the modelling procedure and explains some general results obtained using a basic time-dependent programme for a quiescent, static cloud of constant density and kinetic temperature. The results of each model are extremely sensitive to the input values used for elemental abundances and the initial fraction of H_2, but the equilibrium values of the molecular densities do not depend on the initial distribution of carbon amongst the species C, C^+ or CO. (17 refs.)

121760 Monte Carlo estimation of polarization in reflection nebulae. R.F.Warren-Smith (Phys. Dept., Univ. of Durham, Durham, England).
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.337-47 (Oct. 1983).
A Monte Carlo technique is described for estimating the Stokes parameters of light which has undergone multiple scattering in a model reflection nebula. The method has the advantage of much improved efficiency over previous methods and is also applicable to more general nebular geometries. (19 refs.)

121761 Multiple scattering in the reflection nebula NGC 1999 and the nature of interstellar dust. R.F.Warren-Smith (Phys. Dept., Univ. of Durham, Durham, England).
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.349-58 (Oct. 1983).
A model of the reflection nebula NGC 1999 is developed, which accounts for the available surface brightness, polarization and colour data in terms of multiple scattering of light within a large dust cloud. The results indicate a high albedo for the dust and a low value for the refractive index, possibly due to icy grain mantles. The data are best accounted for if the distribution of grain sizes $n(a)$ is approximately power law with an index -4.24 ± 0.18 in the approximate size range $0.1<a<0.5$ (μm). The observations are consistent with optical interstellar extinction data but the ultraviolet extinction appears to require the index of the power law to be less negative for small grain sizes. (23 refs.)

121762 Analysis of nebulosity in the planetary nebula NGC 40. R.E.S.Clegg, M.J.Seaton (Dept. of Phys. & Astron., Univ. Coll. London, London, England), M.Peimbert, S.Torres-Peimbert.
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.417-34 (Oct. 1983).
Optical and *IUE* spectra of a bright region of nebulosity in the planetary nebula NGC 40 are combined for an analysis of the physical conditions and abundances in the nebula. Resulting abundances are typical of planetary nebulae and indicate that the nebulosity does not share the extreme abundances of the Wolf-Rayet WC8 central star. The continuum observed in the *IUE* spectra at an offset position is fitted to a calculated nebular continuum; the nebular lines are measured relative to the continuum and hence put on the same scale as optical lines measured relative to Hβ. The emission in C IVλ1549 from the nebula may be explained, in part, as due to resonance scattering of radiation from the star or the inner part of the nebula. New recombination lines of C II are identified in *IUE* spectra; their intensities relative to C II $\lambda\lambda$4267, 7230 in NGC 40 and IC 418 are analysed. (39 refs.)

121763 On the physics and chemistry of interstellar matter II. M.Winnewisser (Phys.-Chem., Inst., Justus-Liebig-Univ., Giessen, Germany), G.Winnewisser.
Phys. Bl. (Germany), vol.39, no.8, p.289-95 (Aug. 1983). In German.
For pt.I see ibid., vol.39, no.1, p.9 (1983). Since 1968 more than 50 different molecules have been identified by their absorption and emission spectra in dense concentrations of interstellar gases, mainly in the millimetre wave region. Molecules, ions and radicals which are extremely unstable chemically exist simultaneously with well-known stable molecules. Interstellar isotopic ratios differ from terrestrial ones by a factor of 2 or 3, and this can be explained by stellar nuclear synthesis since the formation of the Solar System. The formation of molecules takes place in the gas phase mainly through ion-molecule reactions and on the surfaces of the interstellar dust. Measurements of the interstellar D:H isotopic ratios confirm the pre-galactic origin of deuterium and hence the big bang theory. The terrestrial plasma chemistry of interstellar molecules is discussed with particular reference to the instruments of mm wave spectroscopy, the detection of new molecules, and the mm wave spectrum of isocyanamide. By means of examples an attempt is made to clarify the relationship between laboratory spectroscopy and space spectroscopy. (26 refs.) *D.J.B.*

121764 High-sensitivity observations of HD 44179: the Red Rectangle. B.J.Geldzahler (E.O. Hulburt Center for Space Res., Naval Res. Lab., Washington, DC, USA), N.L.Cohen.
Publ. Astron. Soc. Pac. (USA), vol.95, no.570, p.489-90 (Aug. 1983).
The authors have observed the Red Rectangle (=HD 44179) with the VLA at 1.465 and 4.885 GHz in search of nonthermal radio emission similar to that of SS 433 due to a suggestion by Webster (1979). To very sensitive limits, there is no radio emission from the Red Rectangle at these frequencies. If it is an SS 433-like object, then its radio-emission intensity is less than $10^{-6.5}$ that of SS 433, which contradicts the similarity in energetics seen in the 'Doppler' broadened optical line profiler of the Red Rectangle. However, the lack of radio emission is consistent with the presence of a bipolar nebula, which would have a 'pressure' broadened profile. (9 refs.)

121765 Photographic infrared observations of planetary nebulae. D.J.MacConnell (Centro de Investigacion de Astron., Merida, Venezuela).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.8, no.1, p.39-43 (June 1983).
Presents the results of an inspection of 740 planetary nebulae on spectrum plates taken in the near infrared. The author confirms the elimination of 48 objects as late-type stars discovered previously by other authors, and eliminates 20 more for the first time on the same basis. Additionally, the author presents another 122 supposed PN which do not show H-alpha emission on the red plates. (20 refs.)

121766 Internal motions in H II regions. XII. S162 and NGC 7635. P.Pismis, M.A.Moreno, I.Hasse (Inst. de Astron., Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.8, no.1, p.51-7 (June 1983).
For pt.XI see ibid., vol.5, no.3, p.209-12 (1982). The apparent structure of S162 and of the Bubble Nebula (NGC 7635) associated with it is discussed using a number of direct images taken through narrow band (10 Å) interference filters in Hα, [N II] and in the continuum at λ6607. The results are discussed together with the radial velocity field of S162 and in particular of the Bubble Nebula as obtained from photographic Fabry-Perot interferometry. The Bubble Nebula is shown to be composed of distinct and amorphous very regularly curving arcs, all inscribed on a tenuous slightly ellipsoidal shell of gas expanding at velocity of about 4 km s^{-1}. The arcs are probably genetically related to the globules which form the characteristic cometlike feature within the Bubble Nebula. The ionization source of S162 is BD+60°2522 and O7I_bf star classified from the high dispersion spectrum. (20 refs.)

121767 The optical emission of the SNR 3C 400.2. M.Rosado (Inst. de Astron., Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.8, no.1, p.59-62 (June 1983).
Narrow band imagery and Fabry-Perot interferometry have been performed on the optical counterpart of this remnant. The Hα and [S II] photographs confirm the high [S II]/Hα ratio already found by spectroscopic means in one of the optical filaments. These photographs also show a series of sharp and bright filaments arranged in a crescent-shaped nebulosity; some of these filaments are oriented in the radial direction. The [O III] photograph reveals the existence of a filament without any Hα counterpart. The kinematical data imply a distance of 6.7 ± 0.6 kpc to this remnant and an expansion velocity of 60 ± 10 km s^{-1}. These values imply that the supernova remnant is in its radiative phase of evolution and that it has an old age. (20 refs.)

121768 Internal motions in H II regions. XIII. The velocity field of Sharpless 184. I.Hasse (Inst. de Astron., Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.8, no.1, p.83-7 (June 1983).
For pt.XII see ibid., vol.8, no.1, p.51-7 (1983). The H II region S184 (NGC 281), presumed to be an evolved one, is situated in the Perseus Arm at a distance of about 2 kpc. The optical extension of the region of around 5 pc shows in projection a complex of different layers of gas and clouds around the central region. This complex has been object of detailed studies before. An H_2O maser discovered earlier has suggested that it marks the site of star-formation. The author gives an extensive radial-velocity field covering the region. (26 refs.)

121769 The infrared spectrum of hypersthene and the interstellar silicate component. J.Dorschner, C.Friedmann, J.Gurtler (Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.1, p.133-8 (1983). In English.
The mass absorption coefficient for hypersthene in the wavelength interval from 8 to 40 μm is derived from spectra for submicrometer-sized grains. The wavelength position and shape of the interstellar 10- and 20-μm silicate features match rather well if the high disorder of the crystal lattice expected under interstellar conditions is taken into account. (14 refs.)

On the effect of interstellar gas on atmospheric oxygen and terrestrial life ....See Entry 121377

Catalogue of nonstellar molecular maser sources and their probable infrared counterparts in the galactic plane ....See Entry 121551

Radial velocities of planetary nebulae ....See Entry 121552

On the nature of early-type stars in the galactic halo ....See Entry 121679

A spectrophotometric study of the T Tauri star AS 353 ....See Entry 121687

Neutral hydrogen observations of double spiral galaxies. III. NGC 3504/3512, NGC 4085/4088, IC 65/UGC 622, NGC 797/801 ....See Entry 121772

Neutral hydrogen observations of double spiral galaxies. IV. NGC 4618/4625, NGC 4016/4017, NGC 3725/UGC 6528, UGC 725/728, NGC 2336/IC 467 ....See Entry 121773

Physical conditions in the nucleus of Seyfert galaxy NGC 7469. II. Spectrophotometric investigation ....See Entry 121777

CCD surface photometry of two southern active galaxies, NGC 1316 1052 ....See Entry 121780

8-13 μm spectrophotometry of galaxies. III. The silicate absorption in Markarian 231 ....See Entry 121781

4.8-GHz H_2CO maser emission in Sgr B2 ....See Entry 121787

Possible nature of the gamma-source 2CG 195+04 ....See Entry 121793

98.50 THE GALAXY, EXTRAGALACTIC OBJECTS AND SYSTEMS

121770 A deep survey of galaxies. R.P.Kirshner (Dept. of Astron., Univ. of Michigan, Ann Arbor, MI, USA), A.Oemler, P.L.Schechter, S.A.Shectman.
Astron. J. (USA), vol.88, no.9, p.1285-300 (Sept. 1983).
The authors present a sample of galaxies in six fields, each of area 2 sq. deg., located in the North and South galactic polar caps. Photoelectrically calibrated photographic magnitudes and $J-F$ colors have been determined for 512 galaxies brighter than completeness limits which range from $F=16.5$ to $F=17.2$ among the fields. Velocities, with typical accuracies of 150 km s^{-1}, have been obtained for 280 of the brighter galaxies. Using these data and previously published work, the authors determine the general galaxy luminosity function parameters to be $M_F{}^*=-22.7$, $\alpha=-1.25$, and the mean visual luminosity density of the Universe to be $\rho=2.3\times10^8\ h\ L_\odot$ Mpc^{-3}. Assuming $M/L_v=300$ h, this implies $\Omega\simeq0.26$. (21 refs.)

121771 Photoelectric comparison sequences in the fields of four BL Lacertae objects. H.R.Miller, T.L.Mullikin, B.Q.McGimsey (Dept. of Phys. & Astron., Georgia State Univ., Atlanta, GA, USA).
Astron. J. (USA), vol.88, no.9, p.1301-3 (Sept. 1983).
Photoelectric comparison sequences in the fields of four previously identified BL Lacertae objects have been calibrated in order to encourage long-term photometric studies of these objects. (9 refs.)

121772 Neutral hydrogen observations of double spiral galaxies. III. NGC 3504/3512, NGC 4085/4088, IC 65/UGC 622, NGC 797/801. G.A.van Moorsel (Kapteyn Astron. Inst., Univ. of Groningen, Groningen, Netherlands).
Astron. & Astrophys. Suppl. Ser. (France), vol.54, no.1, p.1-18 (Oct. 1983).
For pt.I see ibid., vol.53, no.2, p.271-86 (1983). Four binary systems have been observed in the 21 cm neutral hydrogen line with the WSRT. All 8 galaxies have been detected; in the field of IC 65/UGC 622 two additional systems containing hydrogen were found. For these ten galaxies systemic velo-

cities and rotation curves have been derived, and the total mass of each system has been determined in two ways: summing the results from the rotation curves, and calculating the minimum mass which follows from the orbital motion. In two of the four systems (NGC 3504/12 and IC 65/UGC 622) the minimum orbital mass is larger than the mass deduced from the rotation curves. (19 refs.)

121773 Neutral hydrogen observations of double spiral galaxies. IV. NGC 4618/4625, NGC 4016/4017, NGC 3725/UGC 6528, UGC 725/728, NGC 2336/IC 467. G.A.van Moorsel (Kapteyn Astron. Inst., Univ. of Groningen, Groningen, Netherlands).
Astron. & Astrophys. Suppl. Ser. (France), vol.54, no.1, p.19-37 (Oct. 1983).
For pt.III see ibid., vol.54, no.1, p.1-18 (1983). Results of a 21 cm H I line study of five binary galaxies observed in the 21 cm H I line with the WSRT are presented. All ten galaxies were detected in H I, and systemic velocities and rotation curves were determined. The results are discussed in terms of a point mass model for the orbital motion in the pair. Only in the case of the pair NGC 4016/4017 a minimum orbital mass was found which did not exceed the sum of the individual masses. For the other four pairs the individual masses are not sufficient to account for the observed radial velocity differences. (15 refs.)

121774 A near-infrared and optical study of X-ray selected Seyfert galaxies. I. Observations. C.W.McAlary, R.A.McLaren, R.J.McGonegal (Dept. of Astron., Univ. of Toronto, Toronto, Canada).
Astrophys. J. Suppl. Ser. (USA), vol.52, no.4, p.341-62 (Aug. 1983).
The authors present broad-band photometric observations between 0.35 and 3.5 μm for a complete sample of pre-Einstein X-ray galaxies most of which are Seyfert-like in nature. For most of these objects, the flux increases rapidly from the optical into the infrared. Some of the distant, high-luminosity sources however, have relatively flat continua. Multiaperture measurements have been obtained for the nearby extended objects. These show that the stellar contribution to the nuclear light of low- and intermediate-luminosity Seyfert galaxies is often significant. (16 refs.)

121775 New central velocity dispersions for the bulges of 53 spiral and S0 galaxies. P.L.Schechter (Kitt Peak Nat. Obs., Tucson, AZ, USA).
Astrophys. J. Suppl. Ser. (USA), vol.52, no.4, p.425-7 (Aug. 1983).
New measurements of velocity dispersions in the bulges of 53 spiral and S0 galaxies have been carried out using spectra obtained with the 1.5 m telescope at the Whipple Observatory and the 2.1 m telescope at KPNO. (16 refs.)

121776 Luminosity distribution in galaxies. II. A study of accidental and systematic errors with application to NGC 3379. M.Capaccioli (Osservatorio Astrofisico di Asiago, Univ. di Padova, Padova, Italy), G.de Vaucouleurs.
Astrophys. J. Suppl. Ser. (USA), vol.52, no.4, p.465-86 (Aug. 1983).
For pt.I see ibid., vol.40, no.4, p.699-731 (1979). Presents a sequel to a study of NGC 3370 as a luminosity distribution standard. Sources of accidental and systematic errors in ground-based photographic and photoelectric surface photometry of galaxies are discussed. Instrumental and atmospheric convolution effects are analyzed, in particular the structure of the point spread function with application to an E0 galaxy obeying $r^{1/4}$ law. Galactic and extragalactic effects including interstellar extinction and diffuse nebulosities at high latitudes, bright field stars, and galaxies are discussed. All these sources of error combine to restrict the domain of meaningful surface photometry of galaxies to $\mu_B \lesssim 28$ mag arc sec^{-2}. Even at brighter levels, $18 \leq \mu_B \leq 28$, true mean errors less than 0.1 mag are difficult to achieve. (68 refs.)

121777 Physical conditions in the nucleus of Seyfert galaxy NGC 7469. II. Spectrophotometric investigation. V.A.Mineva, G.T.Petrov, B.Z.Kovachev (Dept. of Astron., Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.6, p.713-16 (1983).
The physical parameters characterizing the nucleus are investigated. The observation material comprises: (a) two scanners including the region from 4000 to 7000 Å obtained on a four-metre telescope at the Kit Peak National Observatory in USA, with a spectral resolution of ~Å; (b) five spectra (obtained at positional angles of 51°, 81°, 111°, 141° and 171°) on a six-metre BTA telescope in USSR with a three-cascade IIS UM-92-dispersion of 46 Å/mm; and (c) a scanner including the region 3700-5300 Å, obtained on a five-metre telescope at Mt. Palomar Observatory in USA. Gas composition and electron densities are discussed. (9 refs.)

121778 Rotation, mass and physical conditions in nucleus of spiral galaxy NGC 7537. G.T.Petrov, V.A.Mineva, B.J.Kovachev, G.A.Kyazoumov (Dept. of Astron., Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.6, p.717-19 (1983).
NGC 7537 is actually a member of the double system NGC 7537+NGC 7541. NGC 7537 is referred to type Sbc; a bright nucleus and relatively faint spiral and clearly visible. The rotation curve and galactic structure are discussed. The spectra are also discussed. A stellar magnitude for its nucleus is derived. (9 refs.)

121779 The correlation between colour and line intensities in type-1 Seyfert galaxies. Y.Y.Zhou (Univ. of Sci. & Technol. of China, Hefei, China), T.Kiang, F.H.Cheng.
Irish Astron. J., vol.15, no.4, p.281-7 (Sept. 1982). [received: Sept. 1983]
(Proceedings of the Meeting of the Astronomical Science Group of Ireland, Belfast, Northern Ireland, 15 Dec. 1981).
Examines the correlation between the line luminosity F and equivalent width W of the Hβ and the [O III] λ5007 lines of type-1 Seyfert galaxies and their 'generalized colour differences' $Q_a=(U-B)-a(B-V)$. The authors find that the correlation is strongest for a~1/2. This result suggests that $Q_{1/2}$ rather than $U-B$ better monitors the strength of the radiation beyond the Lyman limit in the nucleus, responsible for producing the emission lines. The authors find that the variation of W [O III] with $U-B$ is in the same sense as that of W(Hβ), in contrast to a previous result by Arakelyan (1977). The authors confirm and extend Petrov's (1979) finding that F gave better correlations than W did, but noted that they also showed much greater dispersions about the regression line. From this the authors infer that there must be a high and positive correlation between F and K, the continuum luminosity at the line concerned, which is duly confirmed for the case of Hβ. (13 refs.)

121780 CCD surface photometry of two southern active galaxies, NGC 1316 1052. D.Carter (Mount Stromlo & Siding Spring Obs., Woden, Australia), P.R.Jorden, D.J.Thorne, J.V.Wall, J.C.Straede.
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.377-88 (Oct. 1983).
Presents surface photometry in five wavebands (*UBVRI*) of two southern active elliptical galaxies, NGC 1316 and 1052, obtained with the recently commissioned RGO CCD camera on the AAT. The speed of the CCD camera enables one to take multiband exposures in quick succession, enhancing stability of the conditions. The authors demonstrate the linearity and stability of the CCD and show that surface photometry is accurate over a wide dynamic range. The morphology of the dust lane in NGC 1316, and the nature of the very red core and a diffuse dust lane in NGC 1052 are discussed. (35 refs.)

121781 8-13 μm spectrophotometry of galaxies. III. The silicate absorption in Markarian 231. P.F.Roche, D.K.Aitken, B.Whitmore (Dept. of Phys. & Astron., Univ. Coll. London, London, England).
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.21p-6p (Oct. 1983).
Spectrophotometry at 8-13 μm of Mkn 231 confirms that the 10 μm minimum is due to large columns of silicate dust in the line-of-sight to the nucleus. Fits to the detailed spectral shape demonstrate that the cool absorbing grains are at the emission (z-0.042) rather than the absorption ($z\sim0.025$) redshift and are located within the nuclear region. (24 refs.)

121782 Interferometric study of NGC 4945. G.J.Carranza, E.L.Aguero (Obs. Astron., Cordoba, Spain).
Observatory (GB), vol.103, no.1056, p.257-9 (Oct. 1983).
Hα interferometric observations of NGC 4945 are discussed. A tentative explanation of the kinematical features is proposed. (6 refs.)

121783 Spectral evolution of galaxies. IV. A catalogue of theoretical predictions of cosmological interest. A.G.Bruzual (Centro de Investigacion de Astron., Merida, Venezuela).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.8, no.1, p.63-81 (June 1983).
Presents in the form of numerical tables a set of results from Bruzual's (1981) spectral evolutionary models for galaxies. (14 refs.)

Catalogue of nonstellar molecular maser sources and their probable infrared counterparts in the galactic plane ....See Entry 121551

Radial velocities of planetary nebulae ....See Entry 121552

Spectral evolution of galaxies. II. An atlas of IUE spectra of late type stars and nearby early type stellar systems ....See Entry 121553

Barium, magnesium and iron in seven chemically unevolved stars and the nuclear evolution of the galactic disk ....See Entry 121676

Programme of studying stellar kinematics in the main meridional section of the Galaxy ....See Entry 121677

Supernovae ....See Entry 121712

Supernova in IOC 1731 ....See Entry 121713

Supernovae ....See Entry 121714

***UBV* photometry of the optical candidate for LMC X-3** ....See Entry 121725

A model of a neutrino stellar system and the upper bound of neutrino mass obtained from the rotation curves of some galaxies ....See Entry 121743

Globular clusters and galaxy formation ....See Entry 121746

Integrated magnitudes and colors of clusters in the Magellanic Clouds and Fornax system ....See Entry 121748

Size distributions of H II regions in galaxies. I. Irregular galaxies ....See Entry 121750

WSRT observations of elliptical galaxies from the B2 catalogue ....See Entry 121786

Photometric television observations of ten peculiar extragalactic objects ....See Entry 121789

Are quasars really far away? ....See Entry 121792

The influence of quantum effects on the space-time structure in the neighbourhood of singularities in the general theory of relativity ....See Entry 121796

Topology of the large-scale structure of the Universe ....See Entry 121797

Gravitational instability for a multifluid medium in an expanding universe ....See Entry 121801

98.50K Groups, clusters, superclusters

121784 Diffuse radio emission from the Coma cluster of galaxies at decametre wavelengths. C.V.Sastry (Indian Inst. of Astrophys., Bangalore, India), R.K.Shevgaonkar.
J. Astrophys. & Astron. (India), vol.4, no.1, p.47-51 (March 1983). [received: Oct. 1983]
The region of the Coma cluster has been observed at 34.5 MHz with a resolution of 26×40 arcmin. A map of the diffuse halo (Coma C) is presented. The size of the halo is found to be 54×30 arcmin. The position angle is 50°±10° and the integrated flux is 60±11 Jy. An extended source has also been found to the south of Coma A. The measured half-power widths of this source are 30×40 arcmin. The position angle is 135° and the integrated flux is ~15 Jy at 34.5 MHz. The spectral index in the frequency range 408 to 34.5 MHz is −1.0. It is suggested that this source also belongs to the Coma cluster. (17 refs.)

Globular clusters and galaxy formation ....See Entry 121746

The influence of quantum effects on the space-time structure in the neighbourhood of singularities in the general theory of relativity ....See Entry 121796

Gravitational instability for a multifluid medium in an expanding universe ....See Entry 121801

The large-scale structure of the Universe ....See Entry 121808

98.70 OTHER OBJECTS AND BACKGROUND RADIATIONS OF UNKNOWN ORIGIN AND DISTANCES

(for pulsars, see 97.60G)

98.70D Discrete radio sources

121785 Precise positions in the FK^4 system for ten optical counterparts of extragalactic radio sources. R.S.Harrington, G.G.Douglass, V.V.Kallarakal, C.A.Smith (US Naval Obs., Washington, DC, USA), H.H.Guetter.
Astron. J. (USA), vol.88, no.9, p.1376-7 (Sept. 1983).
Positions are given in the FK4 system for optical counterparts of ten extragalactic radio sources. (2 refs.)

121786 WSRT observations of elliptical galaxies from the B2 catalogue. L.Feretti (Istituto di Radioastronomia, Bologna, Italy), G.Giovannini, L.Gregorini, P.Parma.
Astron. & Astrophys. (Germany), vol.126, no.2, pt.1, p.311-19 (Oct. 1983).
Presents 4995 MHz observations of 22 radio galaxies from the B2 catalogue. The most frequent type of radio structure found in this sample is the classical double, with linear sizes ranging from tens to hundreds of kpc. Detected degrees of polarized flux density range from 2% to 23%. The orientation of the projected magnetic field is mostly perpendicular to the source major axis. (27 refs.)

121787 4.8-GHz H_2CO maser emission in Sgr B2. J.B.Whiteoak, F.F.Gardner (Div. of Radiophys., CSIRO, Epping, Australia).
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.27p-32p (Oct. 1983).
VLA observations with an angular resolution 2 arcsec have resulted in the discovery of five 4.8-GHz H_2CO masers in the H II-regionmolecular-cloud complex Sgr B2. Only one other H_2CO maser is known (in NGC 7538). Observed with a velocity resolution of 6 km s^{-1}, the maser intensities ranged from 15 to 140 mJy. The strongest masers are located close to H II continuum emission and OH4 and H_2O masers. (9 refs.)

On the possibility of applying undense reference star frames to determining the optical positions of extragalactic radio sources ....See Entry 121544

Catalogue of nonstellar molecular maser sources and their probable infrared counterparts in the galactic plane ....See Entry 121551

Sounding of the supercorona by decametric radiation of 3C 144 ....See Entry 121639

T Tauri South: a protostar? ....See Entry 121682

VLA synthesis of H I absorption toward Sgr A ....See Entry 121752

Gamma-ray line features from the Crab Nebula in the energy range 5-2000 keV ....See Entry 121756

OH maser emission at 4765 MHz in W3 ....See Entry 121757

The optical emission of the SNR 3C 400.2 ....See Entry 121767

Neutral hydrogen observations of double spiral galaxies. III. NGC 3504/3512, NGC 4085/4088, IC 65/UGC 622, NGC 797/801 ....See Entry 121772

Neutral hydrogen observations of double spiral galaxies. IV. NGC 4618/4625, NGC 4016/4017, NGC 3725/UGC 6528, UGC 725/728, NGC 2336/IC 467 .. ..See Entry 121773

CCD surface photometry of two southern active galaxies, NGC 1316 1052 ....See Entry 121780

Diffuse radio emission from the Coma cluster of galaxies at decametre wavelengths ....See Entry 121784

Photometric television observations of ten peculiar extragalactic objects ....See Entry 121789

98.70J Quasars

121788 The Cerro El Roble sample of faint ultraviolet excess objects in the South Galactic Pole. L.E.Campusano, C.Torres (Dept. de Astron., Univ. de Chile, Santiago, Chile).
Astron. J. (USA), vol.88, no.9, p.1304-22 (Sept. 1983).
As a first step towards the formation of a QSO sample in the South Galactic Pole (SGP), a 44-deg^2 area centered at $RA=00^h53^m$ (1950) Decl.$=-28°03'$ has been searched for relative ultraviolet excess objects (UVXs) in five partially overlapping fields of the 70/100-cm Maksutov telescope using an unmodified Zeiss Blink comparator. A total of 373 objects was found which yielded a surface density of 8.6 UVX/deg^2 with $B \lesssim 20$ mag. The search was found to be extremely incomplete at $B > 19$ mag, while the completeness for $B \lesssim 19$ was estimated to be approximately 30% in nonoverlapping regions and 50% in overlapping regions. Only the central overlapping region was used for the comparison of the surface density of different UVX samples. The surface density in this region is 7.2 UVX/deg^2 at $B \sim 19$ mag and approximately a factor of 2 larger than the one found by Savage and Bolton (1979) in two 25-deg^2 fields near the SGP. In addition, the surface density value is a factor of 3/2 larger than the density found by Bracessi, Formiggini, and Gandolfi (1970) near the North Galactic Pole. With respect to the behavior of the cumulative number of the UVX ($N(<B)$) as a function of the blue magnitude, it was found in reasonable agreement with those corresponding to the samples of Haro and Luyten (1962), Braccesi et al. (1970), and Usher (1981). Twenty-seven new QSOs have been preliminarily identified in the UVX sample from spectroscopic data collected on the Las Campanas 2.5-m telescope. With this result, the presently known surface density of QSOs in the 44-deg^2 area amounts of 0.8 QSO/deg^2 at $B \sim 19$ mag, which is about 1/5 of the expected surface density. The fraction of stars encountered in the preliminary spectroscopic evaluation was found to approximately coincide with the expected values. Finally, a statistical test applied to the surface distribution of the UVXs in the central 25-deg^2 region, gave a slight suggestion of nonuniformity when the counts were made with cells of 0.3 deg^2. (34 refs.)

121789 Photometric television observations of ten peculiar extragalactic objects. L.P.Metik, V.V.Prokof'eva.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.148-54 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.140-5 (1981). [received: Oct. 1983]
The high-sensitivity television system working in conjunction with the 0.5-m telescope of the Crimean Astrophysical Observatory was used in 1976 to determine the brightness of extragalactic objects in the BV color system. Five quasars and BL Lac objects with magnitudes in the range between 14.5 and 18.5^m were observed. Three objects (3C 279, OJ 287, and OY 091) exhibited light variation with a characteristic time of a few days. (6 refs.)

121790 Compact structure in the powerful distant radio source 4C 04.81. P.D.Barthel (Sterrewacht Leiden, Leiden, Netherlands), C.J.Lonsdale.
Mon. Not. R. Astron. Soc. (GB), vol.205, no.1, p.395-402 (Oct. 1983).
A radio map of the high-redshift quasar 4C 04.81 from MERLIN at λ 6 cm and a two-component model derived from λ 21-cm European VLBI Network observations are presented. The MERLIN map shows a curved jet leading from the radio core to a bright compact hotspot. Despite the high angular resolution of these observations (<0.1 arcsec), most of the source flux at both frequencies originates in unresolved features. Significantly, it is found that the core component has a steep radio spectrum $\alpha \approx -0.8$ ($S \propto \nu^{\alpha}$). (16 refs.)

121791 Broad emission lines of QSOs are consistent with rotating supermassive stars. G.A.Shields (Dept. of Astron., Univ. of Texas, Austin, TX, USA).
Nature (GB), vol.305, no.5933, p.407-9 (29 Sept. 1983).
Quasars and Seyfert galaxies typically have optical and UV spectra characterized by a largely nonthermal continuum, narrow emission lines, and broad emission lines (full widths at zero intensity $\sim 10^4$ km s^{-1}) observed only in permitted and intercombination transitions. The broad lines come from a small amount of dense, fast-moving gas, in a region $\sim 10^{18}$ cm across near the continuum source. The origin, geometry, and dynamics of the broad line gas are uncertain. It is suggested that the basic properties of the broad emission-line profiles are consistent with emission from the surface of a rotating, supermassive star. (27 refs.)

121792 Are quasars really far away?. J.V.Narlikar (Tata Inst. of Fundamental Res., Bombay, India).
New Sci. (GB), vol.99, no.1377, p.920-2 (29 Sept. 1983).
Discusses the redshift of quasars—and considers the possibility of nearby quasars. A possible mechanism for nearby quasars in the intergalactic medium is discussed. (no refs.)

98.70L IR sources

(see also 98.40 in nebulae)

T Tauri South: a protostar? ....See Entry 121682

A near-infrared and optical study of X-ray selected Seyfert galaxies. I. Observations ....See Entry 121774

CCD surface photometry of two southern active galaxies, NGC 1316 1052 ....See Entry 121780

98.70Q X-ray and gamma-ray sources

121793 Possible nature of the gamma-source 2CG 195+04. B.M.Vladimirskii.
Bull. Crimean Astrophys. Obs. (USA), vol.63, p.155-60 (1981). Translation of: *Izv. Krym. Astrofiz. Obs. (USSR)*, vol.63, p.146-50 (1981). [received: Oct. 1983]
It is suggested that the gamma-source 2CG 195+04 may be a remnant of the supernova explosion of AD 437. This is consistent with existing observational data if the object belongs to the subclass of supernovae without well-defined shell structure (plerions). The spectral index of the source in the radio range is probably $\alpha \lesssim 0.2$, and the flux near 1 GHz is not more than 1 flux unit. In the optical range, this is a weak extended object with a continuous spectrum. The emission recorded in the X-ray range may be due to the pulsar halo. The period of the pulsar is probably about 50 msec. The radio pulsar 2CG 195+04 is probably several times weaker than NP 0532. (22 refs.)

T Tauri South: a protostar? ....See Entry 121682

Expected high-frequency radiation from the 1.5-ms pulsar ....See Entry 121718

10^{12} eV radiation from the X-ray source Cyg X-3 observed at Tien Shan in 1977 and 1978 ....See Entry 121736

A possible variation in the 4.8-hr period of Cyg X-3 ....See Entry 121737

The AM Herculis-type binary E 1405−451 ....See Entry 121740

Colour magnitude diagram for central stars of globular cluster M15 ....See Entry 121745

Gamma-ray line features from the Crab Nebula in the energy range 5-2000 keV ....See Entry 121756

Soft X-rays from very young supernova remnants ....See Entry 121758

A near-infrared and optical study of X-ray selected Seyfert galaxies. I. Observations ....See Entry 121774

98.70V Background radiations

121794 Structure of the cosmic microwave background. J.D.Barrow, R.Juszkiewicz, D.H.Sonoda (Astron. Centre, Univ. of Sussex, Brighton, England).
Nature (GB), vol.305, no.5933, p.397-402 (29 Sept. 1983).
Predicts the structure expected in the cosmic microwave background over large angular scales in realistic anisotropic and inhomogeneous universes. In a homogeneous anisotropic Universe there exist two possibilities, a quadrupole or a hotspot pattern with and without dipole contributions. A hotspot allows a direct observational test of an open Universe. The authors show how infinite wavelength inhomogeneous perturbations of the Friedman Universe can be represented as ensembles of different homogeneous universes. (30 refs.)

121795 Mantle plume noble gas component in glassy basalts from Reykjanes Ridge. R.Hart, J.Dymond, L.Hogan (School of Oceanography, Oregon State Univ., Corvallis, OR, USA), J.G.Schilling.
Nature (GB), vol.305, no.5933, p.403-7 (29 Sept. 1983).
Basalts from the Reykjanes Ridge contain noble gases delivered from the non-degassed lower mantle by the Iceland plume. These lower mantle gases are thought to be a mixture of planetary and solar components, as would be expected if the Earth accreted from fine silicate particles. (42 refs.)

98.80 COSMOLOGY

(for observational cosmology, see 98.70V; for origin and evolution of galaxy, see 98.50)

121796 The influence of quantum effects on the space-time structure in the neighbourhood of singularities in the general theory of relativity. B.B.Palyushev.
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.6, p.767-70 (1983). In Russian.
The fundamental problem of theories of the formation of galaxies and galaxy clusters is that of finding the spectrum of the heterogeneities that gave birth to the present coarse-scale structure of the global Universe. Some of the envisaged ways of finding this spectrum and their theoretical bases are briefly described. It is then postulated that future identification of a black hole in the Cosmos and observation of all available parameters around it could yield information on the nature of the perturbations giving rise to the cosmic heterogeneities, on the assumption that quantum effects taking place in the gravitational field of a black hole can cause some instability in the gravitational background. This hypothesis is analysed on the basis of the relationship between the degree of instability and the temperature of Hawkins radiation. (8 refs.) *A.J.B.*

121797 Topology of the large-scale structure of the Universe. S.F.Shandarin, Ya.B.Zeldovich (Space Res. Inst., Moscow, USSR).
Comments Astrophys. Comments Mod. Phys. Part C (GB), vol.10, no.1, p.33-45 (1983).
Discusses properties of galaxy distribution on scales from a few to several hundred Mpc. The authors analyze in detail the pattern formed by galaxy density enhancements and discuss a new technique for quantitative study of the structural topology. (48 refs.)

121798 Compatibility of a closed singular universe with present observational data. A.G.Agnese, M.La Camera (Istituto di Sci. Fisiche, Univ. Genova, Genova, Italy).
Int. J. Theor. Phys. (USA), vol.22, no.9, p.867-71 (Sept. 1983).
The influence of the constant term Λ on the cosmological equations is investigated. It is shown that a closed singular universe is possible even with the

presently known matter and radiation densities, provided that the universe age is restricted to a suitable range. (9 refs.)

121799 The cosmological problem as initial value problem on the observer's past light cone: geometry. G.Dautcourt (Zentralinst. fur Astrophys., Akad. der Wissenschaften, Potsdam-Babelsberg, Germany).
J. Phys. A (GB), vol.16, no.15, p.3507-28 (21 Oct. 1983).
In the context of general relativity an approach to cosmology is suggested which rests exclusively on quantities accessible to the astronomical observer. The approach is based on the characteristic initial value problem for the Einstein field equations imposed on the observer's past light cone. the inner geometry of the past light cone enters the relations between observable quantities. Thus, it should become possible to determine both the cone geometry, as well as the distribution of cosmic matter near the cone, without adopting arbitrary assumptions. The propagation equations determine the gravitational field and the matter distribution at finite distances from the past cone. The author specifies the cone initial data for a general dust model. An explicit procedure in terms of successive integrations is given to determine the gravitational field near the past light cone. (18 refs.)

121800 The cosmological evolution of general Bianchi models in the adiabatic regime. P.Salucci, R.Fabbri (Istituto di Fisica Superiore, Univ. di Firenze, Firenze, Italy).
Nuovo Cimento B (Italy), vol.77B, ser.2, no.1, p.62-72 (11 Sept. 1983).
The authors analyse the evolution of homogeneous anisotropic cosmologies in the adiabatic regime allowing for a cosmic velocity field and taking into account the contribution of the quantum vacuum to the cosmic energy density. They show that a constant or slowly varying energy-momentum tensor of vacuum isotropizes the Hubble expansion. They suggest, therefore, that an imperfect tuning of field parameters in grand unified theories may naturally explain the isotropy of the Universe. (13 refs.)

121801 Gravitational instability for a multifluid medium in an expanding universe. D.Fargion (Istituto di 'Fisica G. Marconi', Univ. di Roma, Roma, Italy).
Nuovo Cimento B (Italy), vol.77B, ser.2, no.1, p.111-27 (11 Sept. 1983).
Considers the gravitational clustering of a multicomponent fluid in an expanding Newtonian universe, taking into account the mutual gravitational interactions of the medium. The author obtained a set of exact and approximate solutions for two fluid components and for several fluid components: primordial hydrogen and helium or cosmological massive neutrinos of different masses and/or velocity distribution may be described by these solutions. The ratio between the two fluid perturbations, even if originally equal to unity, changes monotonically with time; this phenomenon leads to different epochs for nonlinear clustering that may be reflected into different epochs of galaxy formation. (10 refs.)

121802 Quantum dissipative processes and gravitational entropy of the Universe. B.L.Hu (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
Phys. Lett. A (Netherlands), vol.97A, no.9, p.368-74 (26 Sept. 1983).
The author discusses the meaning of gravitational entropy of the Universe when quantum dissipative processes like cosmological particle production are important and proposes to use the entropy generated in these processes as a measure of the change in gravitational entropy of the spacetime dynamics. Penrose's Weyl Curvature Hypothesis is re-examined in this generalized context. It is shown that gravitational entropy defined as such can actually decrease in the quantum regime by the action of vacuum viscosity. The theoretical and cosmological implications of this postulate is discussed. (23 refs.)

121803 Weyl integrable space-time: a model of our cosmos?. M.Novello, H.Heintzmann (CBPF/CNPq, Rio de Janeiro, Brazil).
Phys. Lett. A (Netherlands), vol.98A, no.1-2, p.10-11 (3 Oct. 1983).
The authors introduce a Weyl integrable space-time as a consequence of a dynamical process. They study the particular case of a vector field nonminimally coupled to gravity. The consequences for cosmology are considered. They find that it is possible to connect one Riemannian region of space-time with another Riemannian region of space-time by a series of Weyl integrable domains. (7 refs.)

121804 The expansion law of the void in the expanding Universe. H.Sato, K.Maeda (Res. Inst. for Fundamental Phys., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.70, no.1, p.119-27 (July 1983).
The expansion of a spherical less-dense region (void) in the expanding Universe is analyzed. Because of a rapid expansion of the void, the surrounding matter is compressed to a thin dense shell and the mass of the shell increases by a snowplow mechanism. The rapid expansion of the void would be interpreted as a 'little bang' caused by the curvature fluctuation in the expanding universe. (14 refs.)

121805 Cosmology from higher-dimensional gravity. Q.Shafi (NASA/Goddard Space Flight Center, Greenbelt, MD, USA), C.Wetterich.
Phys. Lett. B (Netherlands), vol.129B, no.6, p.387-91 (6 Oct. 1983).
A scenario describing how the four-dimensional Friedmann cosmology may evolve from a model of gravity in $4+D$ dimensions which admits spontaneous compactification of D dimensions is presented. In particular, the possibility that the transition to the standard hot big bang model involves an inflationary phase is explored. (10 refs.)

121806 An alternate derivation of radiation in an inflationary universe. R.H.Brandenberger (Jefferson Lab. of Phys., Harvard Univ., Cambridge, MA, USA).
Phys. Lett. B (Netherlands), vol.129B, no.6, p.397-400 (6 Oct. 1983).
The authors derive the nontrivial nature of the quantum field vacuum state in the de Sitter phase of an inflationary universe by explicity calculating the vacuum expectation value of the energy-momentum tensor of a free massless scalar field. This yields an independent verification of the occurrence of Hawking radiation. (11 refs.)

121807 Note on Euclidean Bianchi-type 'cosmologies'. B.K.Berger (Phys. Dept., Oakland Univ., Rochester, MI, USA), A.G.Spero.
Phys. Rev. D (USA), vol.28, no.6, p.1550-1 (15 Sept. 1983).
AN explanation using 'qualitative cosmology' is given for the absence of chaotic behavior in the Euclidean analog of the Bianchi cosmologies. (11 refs.)

121808 The large-scale structure of the Universe. J.Silk, A.S.Szalay, Y.B.Zel'dovich.
Sci. Am. (USA), vol.249, no.4, p.56-64 (Oct. 1983).
Across billions of light-years space is a honeycomb of galactic superclusters and huge voids. The structure may result from perturbations in the density of matter early in the big bang. (no refs.)

Monopolonium ....See Entry 117394

Family symmetries ....See Entry 117410

Collisions to melt the vacuum ....See Entry 117586

Spectral evolution of galaxies. IV. A catalogue of theoretical predictions of cosmological interest ....See Entry 121783

Structure of the cosmic microwave background ....See Entry 121794

Mantle plume noble gas component in glassy basalts from Reykjanes Ridge ....See Entry 121795

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